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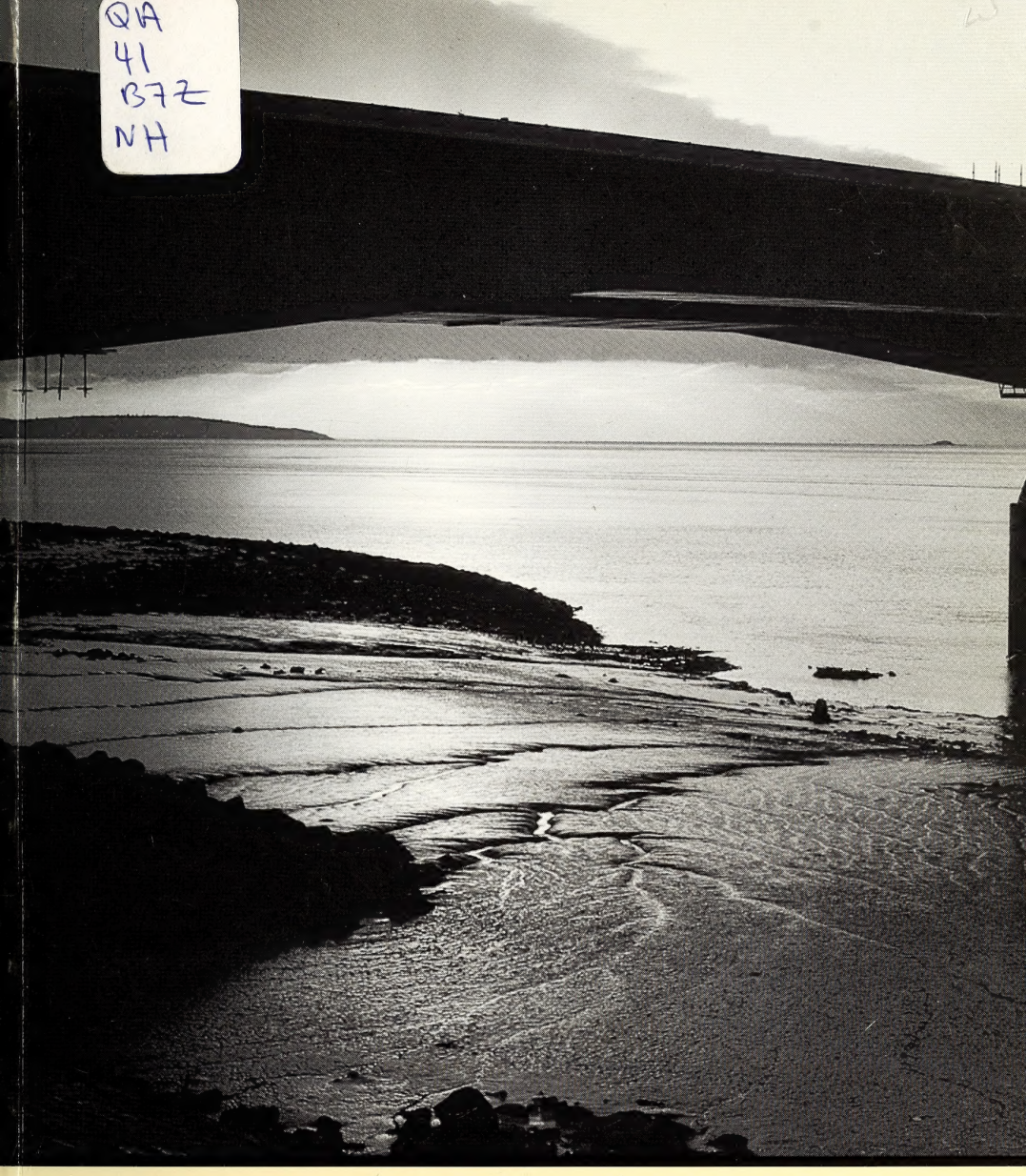

NATURE IN AVON

PROCEEDINGS OF THE BRISTOL NATURALISTS' SOCIETY, 1996

NATURE IN AVON

THE PROCEEDINGS OF THE BRISTOL NATURALISTS' SOCIETY

VOLUME 56 (for 1996)

EDITED BY A. F. HOLLOWELL

ASSISTED BY A COMMITTEE

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FRONT COVER Sunset over the Severn Estuary, from the Second Severn Crossing. Photograph by Professor D. H. Peregrine.

COUNCIL, 1996

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	Hon. Secretary & Treasurer:	Mr R G. L. Holmes
Mammal Group	Convener:	Mr D. P. C. Trump
Invertebrate Group	Convener:	Mr A. G. Smith

Other Members of Council:

Mr J. A. Evans, Mr B. M. J. Gray, Miss S. E. Hallett, Dr M. H. Martin, Mr G. Poole, Mr A. Robinson, Dr H. E. Rose, Mr A. G. Smith

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Hon. **Auditor** (not a member of Council)**:** Mr T. B. Silcocks

REPORT OF COUNCIL, 1996

Membership of the Society stands at 626, including Honorary and Life members and 13 juniors; 102 new members have joined during 1996.

During the year the Society and its sections held 83 meetings. Two section meetings with wider appeal formed part of the general lecture programme. The mammal & invertebrate groups thrive: each has arranged lectures & surveys. The 1996/97 lecture programme was included in the widely disseminated calendar of local events in science, engineering and technology produced by The Exploratory.

Members have received ten monthly Bulletins, the 1994 Proceedings published in September, the 1995 Avon Bird Report also in September & a current members' list in November. Council records thanks to the many volunteers who distribute these items to members. Work on the 1995 *Proceedings*, a theme issue on the Mendips in collaboration with the Mendip Society, was well advanced by the year end. It was announced during the year that *British Birds* magazine had awarded the prestigious title of Best Bird Report to the 1994 *Avon Bird Report*. Congratulations are due to all who helped produce this volume.

Council supported the following projects during 1995: from the Hector Hockey Fund, a study on the Small Pearl Bordered Fritillary Butterfly (£175 - Mr J. Board); geological information boards on the Bristol-Bath railway path and on Avon Ring Road cycle-path (£175 - Mr S. Carpenter); papers in the Society's *Proceedings* for 1995 (£300): Dormouse nest boxes in Midger Wood Nature Reserve (£100 to Mrs P. Woodbridge); and from the Conservation Appeal, £150 towards the cost of a hut to be used by amateur groups making long-term studies in the Gordano Valley National Nature Reserve.

Our late member Mrs I. C. I. Milton, who died in 1980, had left the Society a share of her estate subject to certain life interests which came to an end in 1995. The Society has received, including accrued interest, a total of £18,028.57. Of this, £4,000 was added to the capital of the Hector Hockey Memorial Fund, and the remainder to our Memorial Fund which holds legacies and gifts in memory of former members.

Some members of Council continued to be responsible for managing the Gloucestershire Wildlife Trust's Wetmoor Nature Reserve, part of the Lower Woods near Wickwar. During the year, in lieu of death duties on the estate of the late Duke of Beaufort, the whole of the Lower Woods became a nature reserve under the care of the Trust and we were formally represented at its dedication by our President and by Council Members, two of whom are members of the new management committee. We are represented on Leigh Woods Management Committee by our President and continue liaison with the Avon Wildlife Trust on the common ground of conservation. Many of our members belong to this Trust and play active roles there. During the year our long-time member Mr F. G. Quinney retired after 10 years as an honorary Reserve Warden. Others contributed to the successful Peregrine Watch organised by Bristol Ornithological Club, which featured in the television programme 'Fear of the Falcon'. Two members of

Council were featured in *Wild Site*, the newsletter for Leigh Woods. The President and member Mr N. Wray appeared on the HTV programme 'Westwatch.'

In the spring of this year cleaning work on the Suspension Bridge caused serious pollution of important botanical sites in the Avon Gorge; BNS members alerted the authorities and advised on palliative action. Council has also responded to proposals for development on Brean Down and at the Congresbury watercress beds. Preparations have been made for a special series of walks as part of the Cabot 500 celebrations during 1997.

Council records with regret the death during 1996 of the following members: Mr J Bignell, Mr V. D. Dennison, Miss I. F. Gravestock, Mrs E. I. Jones, Mrs E. Vaughan Davies, Miss M. V. Westcott and Dr T. Wilton. Mr Dennison joined in 1955 and was President in 1983/84. He was active in the Geological Section and was its current Treasurer. As a member of our Council and Honorary Treasurer of the Mendip Society he proposed and facilitated the Mendips issue of the Proceedings now being prepared. Miss Gravestock was active in the Botanical Section and also for many years was deeply involved in the work of our Conservation Committee. After the formation of the Avon Wildlife Trust she liaised with it on our behalf.

SYLVIA P. KELLY, *Honorary Secretary*

GENERAL MEETINGS, 1996

27 Jan. Annual General Meeting & Presidential Address- "Bugs and Beasties" by Mr R. J. Barnett

10 Feb. "Arctic ecology", by Dr N. R. Webb.

. 9 Mar "Natural history at the Bristol City Museum", by Mr R. J. Barnett.

10 Oct. "Environmental impact of management of the wet grassland in the Somerset Levels and Moors", by Mr D. Glaves.

13 Nov. "Wildlife of Zambia - mammals and birds", by Mr M. Mockler (Joint meeting with the Ornithological Section).

7 Dec. "Hedgehogs", by Dr P. A. Morris (Joint meeting with the Mammal Group).

GENERAL FIELD MEETINGS, 1996

These meetings were organised by the Field Committee, whose members were:

Chairman - Miss S. M. Garden, Hon. Secretary - Miss R. C. Lee, Committee members - Miss S. M. McCarthy and Miss M. B. Morris.

The following meetings were held under the leadership of those indicated:

23 Mar. Miss S. M. Garden: the Holford area, Quantock Hills.

A walk up on to Longstone Common, with many signs of spring in evidence. There were a few woodland birds and a few members saw a Dartford Warbler.

5 Apr. Miss S. McCarthy: Lady Hill Wood, Usk.

A walk through fields and woods on a glorious spring day. We saw some woodland birds and a few early spring flowers, especially Wood Anemones.

18 May Miss R. C. Lee: Wylye Valley, near Warminster.

The weather was poor but the bluebell woods were magnificent. We heard woodland birds and found some of the large Roman Snails.

8 Jun Mr S. R. Howe: Neath Valley.

A walk up Afon Nellte to Porth-yr-Ogof and back, on a glorious sunny day. The leader very ably described the birds, flowers and geology of the area.

6 Jul. Miss M. B. Morris: The River Otter, Devon.

A walk from Otterton to Budleigh Salterton, during which we heard many birds and and saw many plants along the river. This was followed by a wet afternoon walk over Aylesbeare Common, a property in the care of the Royal Society for the Protection of Birds.

1 Sep. Mr D. A. C. Cullen: Keyhaven and Pennington Marshes, Dorset.

A walk along the sea wall, with excellent views of birds, identified by the leader, on both the seaward and the landward sides of the path.

26 Oct. Miss S. M. Garden: Dinsmore Manor Garden & Queenswood Arboretum, Herefordshire.

On a sunny autumn day, the *Acers* in both garden and arboretum were magnificent. A number of fungi were found.

23 Nov. Mr S. R. Howe: The National Museum of Wales.

By prior arrangement, we were taken behind the scenes in three departments. After lunch we visited some of the public galleries. This was a very popular visit.

RACHEL LEE, *Hon. Secretary*

REPORT OF THE BOTANICAL SECTION, 1996

At the Annual General Meeting, held on 23 January 1996, Officers and Committee members were elected as follows: President - Mr A. C. Titchen, Hon. Secretary and Treasurer - Mr C. Hurfurt; Committee members - Miss I. F. Gravestock, Ms S. Hallett, Ms L. Houston, Mr M. A. Kitchen, Mrs C. Kitchen, Dr N. Malcolm, Mrs P. M. Millman, Mr A. G. Smith, Mr L. J. Taylor, Mrs H. E. Titchen and Mrs M. A.

Webster. Mr A. G. Smith, having stepped down from the posts of Hon. Secretary and Treasurer, was thanked for the work he had done in that capacity.

The following indoor meetings were held:

23 Jan. Annual General Meeting, followed by members' exhibits.

20 Feb. "The History of the Apple", by Mr G. Gilbert.

19 Mar. "William Turner, the Father of English Botany", by Mr A. G Smith.

21 Oct. "Fragile Icelandic ecosystems", by Dr K. Crabtree.

9 Nov. The herbarium at the Bristol City Museum, led by Ms S. Hallett.

17 Dec. "Walks and wanderings in the Mendips", by Dr K. C. Allen.

The following field meetings and visits were held, under the leadership of those shown:

6 Apr. *Gagea lutea* and *Tulipa sylvestris* in South Gloucestershire, Mr A. C. Titchen.

21 Apr. Asham Wood, near Frome, Mr. W. Corns of English Nature.

8 May. Bithams Wood, near Winford, Mrs M. A. Webster.

13 Jun. Frenchay Hospital grounds, Mr L. Taylor.

16 Jun Pewsey Downs, Mrs M. A. Webster & Mr A. C. Smith.

3 Jul. Durdham Down, Mr A. C. Titchen.

15 Jul. Tree Watch walk round Clifton, Mr A. C. Titchen.

7 Aug. Hengrove Park, Mr C. W. Hurfurt.

10 Aug. Pill Wharf, Mrs P. M. Millman & Mrs H. E. Titchen.

31 Aug. Avon Ring Road Stage II, Mr C. W. Hurfurt.

15 Sep. Wye Valley woodlands by Mr & Mrs M. A. Kitchen.

3 Nov. Fungus foray in Great Breach Wood, Mr J. G. Keylock.

We cannot end this report without mentioning with regret the death in December of Florence Gravestock, who gave long service as our Hon. Secretary and as a Committee member and led many outdoor meetings. She will be much missed. An obituary appears elsewhere in this issue.

CHRISTOPHER HURFURT, *Hon. Secretary.*

REPORT OF THE GEOLOGICAL SECTION, 1996

The year commenced with the Annual General Meeting of the Section, held on 17 January, at which Mr D. W. Cope was re-elected as President, Dr M. Simms as Hon. Secretary and Mr S.C. Carpenter as Hon. Field Secretary. Members elected to the Committee were: Mrs M. E. Poolman, Dr M.J. Simms and Mr D. A. Wilson.

However, in late Spring, Dr Simms left Bristol to take up a post at the National Museum of Ulster, Belfast and the duties of Hon. Secretary were taken over by Mr Jon Radley. Thanks are due to Dr Simms for his work while holding that post.

Of the indoor meetings, that held in November on insects in amber, was particularly popular, attracting an audience of 34. During the year the Section, through Mr Carpenter, made successful applications to the Hector Hockey Fund, the Geologists' Association's Curry Fund, the South Gloucestershire Council, the Bath & N. E. Somerset Council and SUSTRANS, for funding for the production of two information boards about the Pennant Sandstone outcrop along the Bristol to Bath Railway Path and the Avon Ring Road Cycle Path.

The following indoor meetings were held:

17 Jan. Annual General Meeting, followed by the Presidential Address, "A geologist in the mires".

21 Feb. "Early history of Planet Earth" by Dr Hugh Rollinson.

20 Mar. "A geologist trekking across the Atlas Mountains" by Dr M. J. Simms.

16 Oct. "Lower Cretaceous dinosaur remains in a Romanian bauxite mine", by Dr Elizabeth Cook.

20 Nov. "Fossil insect remains in amber deposits" by Mr Andrew Ross.

18 Dec. Annual Members' Evening with a demonstration by Mr S. C. Carpenter of recent finds of vertebrate fossils.

The following field meetings were held under the leadership of those shown, with meetings held jointly with Bath Geological Society being indicated by * :

28Apr. "Callovian delights of the south Cotswolds", Mr Neville Hollingworth.*

12 May "Wick Quarry, Avon", Mr Alan Bentley.

14 Jun. "The building stones of Clifton", Professor R. J. G. Savage.

14 Jul. "The new Aust section at Manor Farm", Mr S. C. Carpenter and Mr J. Radley.*

22 Sep. "Silurian Rocks of the Tortworth Inlier", Mr Charles Hiscock.*

2 Nov. "Geologists' Association Annual Reunion, London".*

JON RADLEY, *Hon. Secretary*

REPORT OF THE ORNITHOLOGICAL SECTION, 1996

The 72nd Annual General Meeting of the Section was held on 17th January 1996 . Mr R. L. Bland was elected as President in succession to Mr T. G. Evans, who wished to retire. Mr R. G. L. Holmes was re-elected as Hon. Secretary and Hon. Treasurer. Mr P. J. Chadwick was elected to the Committee and the remaining Committee members were Mrs J. Fowles, Mrs J. M. Lance, Mr J. G. Prince, Mrs

S. E. Prince and Mr B. M. J. Gray, the latter a previously co-opted member. Mr T. B. Silcocks was appointed as Honorary Auditor.

The indoor meetings were as follows.

17 Jan. Annual General Meeting with a video presentation on "Migration", by the President, followed by a discussion.

14 Feb. "Birds and other wildlife of Nepal", by Mr D. Cottridge.

15 Mar. "Birds and other wildlife of North Africa", by Mr P. Basterfield.

9 Oct. "Reflections of a wildlife artist", by Mr M. Ridley.

13 Nov. "Wildlife of Zambia - mammals and birds", by Mr M. Mockler.

11 Dec. "Birding on the Pearl River estuary, Hong Kong", by Dr H. E. Rose.

There were 20 field meetings. Guided by attendance figures in recent years, the Committee decided to include fewer long-range trips in the summer programme and to offer a midweek, local evening walk, each week throughout the breeding season, which provided some first-rate birding.

During the year, members again supported long-term national enquiries organised by the British Trust for Ornithology, including the Common Bird Census scheme, Heronry counts, the Birds of Estuaries Enquiry and the Wetland Bird Survey. The Section organised the BTO's National Rook Census locally and undertook a small trial of the fieldwork proposed for a national Skylark survey. Members continued to support the national and local Breeding Bird Surveys and this year over 100 one-km squares were covered. A number of members also carried out winter counts, in the same squares, as part of a survey of winter populations. Work continued on two long-term local enquiries, into birds using gardens in winter and into over-wintering warblers. In addition, a full survey was carried out, for the second year running, of all the rookeries in the area of the former county of Avon; it revealed an unexpected 10% increase. A survey of Song Thrushes continued.

RICHARD HOLMES, *Hon. Secretary*

REPORT OF THE INVERTEBRATE GROUP, 1996

Mr A. G. Smith kindly agreed to act as convener for the fledgling (larval?) Group, before the formation of a full Section. Consequently a varied programme of m0000eetings was arranged for summer and winter. In addition, the Society's A.G.M. on 27 January included a Presidential address with an invertebrate theme when Ray Barnett spoke on "Bugs and Beasties", an examination of the Hemiptera.

The following indoor meetings were held:

1 Oct. "Plant Galls" by Janet Boyd

6 Nov. "First catch your mini-beast" by Pat Hill-Cottingham

The following field meetings were held, under the leadership of those shown:

11 May	East Dundry - Tony Smith.
23 June	Kenn Moor - Simon Randolph.
30 June	Lords Wood - Justin Evans.
13 July	Weston Big Wood - Bill Dixon.
10 Aug.	Folly Farm - joint meeting with Bristol & District Moth Group.

A.G.SMITH, *Convener*

REPORT OF THE MAMMAL GROUP 1996

During the year, the Group arranged a series of talks and field meetings in association with the Avon Bat Group and the Mammal Society. Mammal records continue to be collected and are summarised in the Avon Mammal Report in this issue.

The following indoor meetings were held:

26 Mar.	"How bats sense the world" by Dr Gareth Jones.
7 Dec.	"Hedgehogs" by Dr Pat Morris - joint General/Mammal Group meeting

The following outdoor meetings were held:

21 - 28 Apr.	S.mall Mammal Trapping in the Gordano Valley National Nature Reserve (part of the Mammal Society's National Vole Survey).
9 Jun.	Bat Box checking around Chew Valley and Blagdon Reservoirs.
8 Sep.	Bat Box checking around Chew Valley and Blagdon Reservoirs - a joint meeting with Avon Bat Group.
3 - 10 Nov.	Small Mammal Trapping in the Gordano Valley National Nature Reserve (part of the Mammal Society's National Vole Survey).

DAVID TRUMP, *Leader*

REPORT OF THE LIBRARY COMMITTEE, 1996

Mrs. A.F. Hollowell was elected as Honorary Librarian. The Library Committee was chaired for 1996 by Roger Symes and met on five occasions, with two working parties being held. Members of the Committee continued to staff the Library from 12.30 to 1.30 p.m. on Wednesdays, and from 10.15 am to 12.00 noon on Saturdays. During the year 42 members made 274 visits and borrowed 261 items. In addition there were 44 visits by Museum staff. These were all very welcome increases on 1995.

Sixteen books were purchased. Twelve donated books were accepted into the library stock and over 200 issues of journals, reports and memoirs were given,

together with offprints, newspaper cuttings of local interest and one video. For all these we are indebted to Avon Butterfly Project, Dr. R. Bradshaw, Bristol and District Moth Group, Bristol Environmental Records Centre, Mr. and Mrs. J. Cleeves, Mrs. A. F. Hollowell, Dr. E. L. Jervis (in memory of Miss Margaret E. Jervis), Dr. M. H. Martin, P. J. M. Nethercott, F. M. Peddle, J. Radley, R. W. Rowe, R. B. J. Smith, R. G. Symes, S. G. Thomas, D. P. C. Trump, E. C. Trump; University of Bristol and Dr. L.C. Frost; Professor A .J. Willis and D. A. Wilson. . Special name plates are added to books given to the collection by members. Twenty-five journals were purchased by subscription, 41 were received by exchange and 8 were gifts or free. Three volumes were bound during the year.

Whilst it is normal practice that most books and journals received as gifts are retained in the Library collection, some little-used library books and journals were sold in 1996 and the proceeds will be used for library purposes.

The Society thanks Mr. Stephen Price, Head of Museum and Leisure Services, Bristol City Council for the continued use of the Library room and for the assistance given to members during the year by Museum staff.

The Committee welcomes the increased use being made of the Library by members and by Museum staff.

ROGER SYMES, *Chairman, Library Committee*

REPORT OF THE PUBLICATIONS COMMITTEE, 1996

The *Proceedings* for 1994 (Vol. 54) were published just before Easter. A different printer was used, who was able to use Perfect Binding instead of stitching. This saved some £300, which made it feasible to include some colour plates. The issue was well-produced and the colour plates, which were produced from colour transparencies of rare moths, were particularly pleasing. With Volume 54, the opportunity was taken to change the spine labelling so that it reads downwards, in conformity with British Standard 6738: 1938 (ISO 6357-1985). This should be an advantage to booksellers displaying the *Proceedings* for sale.
Committee members were deeply saddened to hear of the death of V. D. (Vic) Dennison in April of this year. Mr Dennison, lately President of The Mendip Society and also a Past President of The Bristol Naturalists' Society, took a leading part in planning the *Proceedings* for 1995 (Vol. 55), the Special Issue devoted to The Mendips. That volume contains an Obituary and is dedicated to his memory.

The Publications Committee met three times during the year. A list of the Society's members was completed and circulated to those members in duplicated form, for their exclusive use only. The credit for the production of this list goes to Mr S. M. Taylor who, as a Committee member, has also been working on an index to the *Proceedings,* covering 25 years and which appears in this issue.

Thanks must be expressed to Dr C. Little who stood down at the end of 1996, having been a member of the Committee since 1979. In conclusion, the Editor

would like to express her appreciation of the support provided during the year, by the Chairman and members of the Committee.

ANNE F. HOLLOWELL, *Hon. Editor, Proceedings*

OBITUARY

IVY FLORENCE GRAVESTOCK, 1908 -1996

Members were saddened to learn of the death of Florence Gravestock on 9 December 1996 at the age of 88. That she attended a meeting of the Friends of Bristol Art Gallery on that day shows how she had remained active up to the very end of her life.

Florence was born in London on 8 August 1908. She went to school there and then in Surrey, She also came to know and love Upper Teesdale and the Pennines and her lifelong interest in botany began very early, when she was only seven years old. In 1927, she went up to Somerville College, Oxford, where she obtained an Honours degree in Classics. Subsequently, she went on to obtain a Teacher's diploma at Leeds University in 1934. She then worked for the Unemployment Assistance Board until 1938, when she moved to live near Bristol. Later, from 1948, she worked as an Executive Inspection Officer for the Ministry of National Insurance, until she retired in 1969.

Retirement gave Florence more time to pursue her special interests, not only botany but also music and painting. Florence was accomplished on the piano and she played in many public concerts until arthritis eventually forced her to give up. After she retired, she continued to paint and was successful in selling several paintings.

Florence joined the Bristol Naturalists' Society in 1949 and was first elected to the Society's Council in 1958. She was Vice-President of the Society in 1978 and also in 1979, the year when she was made an Honorary Member. Her greatest contribution to the Society, however, was her work for the Botanical Section. From 1962 to 1978, she was a most assiduous and efficient Hon. Secretary and Treasurer of the Section. She also led one field meeting, sometimes two, nearly every year, amounting to 30 in all! In the early years, she was especially interested in the eastern Mendips and she continued to study Cheddar plants but, in later years, she usually led meetings near to her home which was now in Bristol; these meetings were often in Stoke Bishop or Shirehampton. Florence also retained her interest in the flora of Upper Teesdale and gave several talks to the Section on the flowers of that area.

Florence made many important contributions to plant recording. From 1965, she was a member of a team led by Miss M. H. Rogers, studying the Cheddar Gorge; Florence was responsible for identifying the species of flowering plants involved. The team's 'Cheddar Gorge' was published, under joint authorship, in the Society's *Proceedings* for 1969 and, for this, Florence wrote the Section on the botany of the Gorge.

Early in the 1960s, which saw the beginnings of many conservation groups, Florence became a founder member of the Gloucestershire Trust for Nature Conservation. She later joined the Somerset, Yorkshire and Avon Trusts. In 1966 she was elected to the BNS Conservation Committee and worked with other members, particularly Mr K. T. Batty, to survey and report on sites in the Bristol District. She assisted with the bid by the Somerset Trust to get Windsor Hill Marsh, near Shepton Mallett, declared a Site of Special Scientific Interest and this was successful in 1970.

The Society's Conservation Committee devised two nature trails which have continued in use for many years. One, through Ashton Court Park, opened in 1970 and the other, along the Frome Valley, in 1976. The trail guides included drawings of plants by Florence, who also contributed to the texts of the booklets. These trails were mounted in conjunction with Bristol City Council, which published the guides. Florence wrote two papers for the Society's *Proceedings*. The first was 'Avonmouth, the vanishing habitat' which appeared in the issue for 1974 (Vol. **34** pp. 105 -11).

The Conservation Committee came to the end of its very active life in 1978 and, by then, Florence, with other members of the Committee, had begun to work with the fledgling Avon Wildlife Trust. Eventually, Florence was elected to the newly-created post of BNS Conservation Liaison Officer, to maintain a link with the Wildlife Trust and other active groups and to provide Council with regular reports on local conservation activities. Her second paper for the *Proceedings,* on 'Nature conservation in the Bristol region: an account of the work of the Society's Conservation Committee', appeared in the issue for 1986 (Vol. **46**, pp 25-32).

Over the years, many botanical records in the *Proceedings* have borne the initials 'IFG'. Of particular note was her find in 1977 of the uncommon coastal halophyte, *Atriplex longipes* Dreger, the Long-stalked Orache, at Lamplighters, Shirehampton. This was the first authentic record of this species for Vice County 34; it was determined by P. M. Taschereau. In the following year, Florence also found the hybrid *Atriplex longipes* Dreger x *prostata* Boucher ex DC., in the same place. This find, also, was authenticated by Taschereau, who visited the site.

Further afield, Florence maintained her interest in the flora of Upper Teesdale, and, in 1979 she was elected to the Conservation Committee of the Botanical Society of the British Isles, and helped with work by the BSBI to map the plants of Upper Teesdale when that area was threatened by developments. Later, when the BSBI held a field meeting in Bristol in August 1983, Florence, with other members of the BNS Botanical Section, contributed to the success of the weekend.

The 1980s saw Florence very active on the Steering Committee of the Avon Flora Project, which was based on the Bristol City Museum's Bristol Regional Environmental Records Centre, with which she worked from 1985. Nearer to home, now in Stoke Bishop, she devised the still popular Stoke Bishop Nature Trail, completed in 1985 for the Stoke Bishop Community Association.

In her later years, Florence moved to live in a residential home on Stoke Hill and developed an interest in trees. She was particularly thrilled to find, in the grounds

of the home, a superb specimen of the Red Seed-winged Sycamore, *Acer pseudoplatanus* f. *erythrocarpus*. She also joined the writer on some of his 'Tree Gazing' trips. The genus *Hedera* became of great interest to her, and on walks around the lanes of Stoke Bishop she pointed out many different species and varieties.

When someone dies, it is sad and there are always questions that have been left unasked. Florence was a close friend of myself and my wife Helen, but why did we always call her Florence, not Ivy? We shall never know the answer to that but at least we can now see how appropriate was her interest in the genus *Hedera*!
Many Society members attended her funeral and it was nice to join with her close relative in saying goodbye to such an active and kind lady, who made bequests to several local organisations concerned with conservation, including our own

A.. C. TITCHEN

Note: The author and the Hon. Editor are grateful to Professor A. J. Willis and to Mr P. J. M. Nethercott for additional information and advice.

THE SOCIETY'S ACCOUNTS FOR 1996

These are on the next two pages. The Hon. Treasurer for 1996, Mr S. M., Taylor, is grateful to Mr R. G. Symes and Mr T. B. Silcocks for completing their preparation when he was unable to do so through indisposition. Our Charitable Funds have been re-organized in preparation for the much fuller Accounts which will be needed in future years under provisions of the new Charities Act.

NOTES TO THE ACCOUNTS FOR 1996

1) The accounts do not show balances held by Section Treasurers nor the Ornithological Section's Special Fund.

2) Council merged the former Williams and Harry Savory Funds, together with the Milton and other bequests, to form a new Memorial Fund.

3) Grants made from the Memorial Fund were: printing membership cards (£117) and Library Rules (£20); Library book in memory of Mrs V. J. Kenney (£50); donation to Museum Staff Fund (£25).

4) The Hector Hockey Memorial Fund is represented by the Income Bonds and National Savings Account. £1,000 of income which had been wrongly converted to capital was replaced following Charity Commission guidance.

5) A £1,000 income bond, previously assigned to the Hockey Fund, was added to and formed the Milton Fund, intended to further support the aims of the Hockey Fund.

6) The Library Fund represents the yield of special sales made in 1995, which Council agreed might be devoted to Library expenditure.

STATEMENT OF ACCOUNTS, 1996

1995	*INCOME - GENERAL FUND*	*1996*
4188	Subscriptions	5034
10773	Donations to General Fund	22
179	Proceedings -(incl. Grant £100)	150
3337	Library sales	36
93	Field Committee transfer of surplus funds	333
554	Bank Interest (Incl. Field Committee £3.45)	752
128	Supper Profit	64
19253	TOTAL INCOME	6391

1995	*EXPENDITURE - GENERAL FUND*	*1996*
1040	General Printing and Stationery	294
697	General Postage and Telephone	151
599	Library	549
672	Meetings	557
2436	Proceedings and Avon Bird Report	862
52	Bank Charges	28
	Bulletin Printing and Distribution	1819
200	Section grant	100
397	Donations to other organisations	0
	Subscriptions to other organisations	19
	Subscription refund	10
13160	Surplus (Deficit) on year	2002
19253	TOTAL EXPENDITURE	6391

BALANCE SHEET at Dec. 31, 1996

1995	*ASSETS*	1996
6000	National Savings Income Bonds	10000
1239	National Savings Bank	2170
1399	Cash at Bank - Current Account	334
21317	Cash at Bank - Treasurer's Account	26910
40	Cash in Hand - Treasurer	0
139	Pre-Payments	357
0	Debtors	0
-2478	Less Creditors - (Curry Fund 1500) (Advance subs 1997 813),	-2367
27656	TOTAL	37404

	REPRESENTED BY	
7098	General Fund at 31st December 1995	6958
13160	Add General Fund Surplus (Deficit) on yea	2002
	Special Funds at 31 Dec 1996	
68	*Harry Savory Illustr Fund*	0
342	*RG Williams Memorial Fund*	0
	Memorial Fund	13377
6752	*Hector Hockey Fund*	7001
	Milton Fund	5070
235	*Conservation Appeal*	110
	Library Fund	2886
27656	TOTAL	37404

SPECIAL FUNDS (FORMERLY CALLED BENEFACTORS' FUNDS)

1995	RECEIPTS AND PAYMENTS DURING THE YEAR	1996
	Memorial Fund	
	Amalgamates Williams and Savory Funds, Milton Bequest, and new monies	
342	Incorporation of R.G. Williams Fund at 31 Dec 1995	342
68	Incorporation of Harry Savory Illustrations Fund at 31 Dec 1995	68
10000	Incorporation of Mrs.I.C.I. Milton's Bequest as at 31 Dec 1995	10000
0	Further I.C.I Milton Bequest received in 1996	8029
0	Memorial Fund Donations received in 1996	200
0	Less transfer to National Savings Account as Hockey Fund Income	-1000
0	Less transfer to Income Bonds as Milton Fund	-4000
0	Less Memorial Fund Grants taken up in 1996	-262
10410	Memorial Fund balance at 31 Dec 1996	13377
	Conservation Appeal	
325	Balance at end of 1995	236
237	Donations received in year	24
-325	LESS Grant taken up in 1996 (Gordano Valley Ringing Hut)	-150
237	Conservation Appeal balance at 31 Dec 1996	110
	Hector Hockey Memorial Fund	
5041	Endowment capital (Income Bonds and £40.63 Nat. Savings)	5041
1776	Balance of income at end of 1995	711
422	Investment Bond Income 1996	324
	National Savings Bank Income 1996	24
0	Replacement of income	1000
-487	LESS Grant taken up (Midger Wood)	-100
6752	Hockey Fund balance at 31st Dec 1996	7001
	Hockey Fund Income c/f to 1997	1960
	Milton Fund	
0	Capital (Unrestricted) (Income Bond) at end of 1995	1000
0	Balance of income at end of 1995	0
0	Transfer from Memorial Fund (Income Bonds - Capital)	4000
0	Investment Bond income 1996	65
0	National Savings Bank income 1996	5
0	Milton Fund balance at 31st Dec. 1996	5070
0	Milton Fund Income c/f to 1997	70
	Library Fund	
3300	Proceeds of sale of surplus material in 1995	3300
0	Expenditure from Library Fund in 1996	-414
3300	Library Fund balance c/f to 1997	2886

Signed:

R. G. Symes, *Hon. Treasurer,* 28/4/99. T. B. Silcocks, *Hon. Auditor*, 28/4/99.

INSTRUCTIONS TO AUTHORS

The editor welcomes original papers on the natural history of Avon and surrounding areas for consideration for publication in the *Proceedings.* Inexperienced authors may obtain advice from members of the Publications Committee. Authors should bear in mind that their readers will not usually be specialists in the particular subject, and that unnecessarily technical language can be a barrier to understanding.

All PAPERS for considerartion should reach the editor by the end of Augustin each year. If there is likely to be a problem with this target date please contact the editor in advance. All SOCIETY REPORTS etc should reach the Editor by the end of February in the next year.

Manuscripts should be double-spaced, with wide margins, and on one side of the paper only. The author should retain a copy. The wording should follow the style and format of the *Proceedings*. Abbreviations should not normally be used, especially in references. An abstract should be supplied. The text should be broken up by appropriate headings and sub-headings and accompanied by relevant illus-trations. Captions to illustrations should be given separately at the end of the text.

Originals, not copies, of photographs, slides, line drawings, diagrams and maps should be submitted - returnable on request. Drawings and other diagrams should not be more than twice final size, and made in black medium. Photographs and slides may be submitted as prints, positives or negatives, preferably monochrome. Graphs, charts and simple diagrams may most readily be produced by computer graphics; advice and help with this are available.

References should be listed at the end of the text in alphabetical order of the first author's name, and should take the following form.

Book: AUTHOR (DATE). Title. Place of publication, Publisher. E.g.,

RACKHAM, O. (1986). *The history of the countryside*. London, J. M. Dent.

Paper: AUTHOR (DATE). Title. Journal name, volume, (part), page nos. E.g.,

ROSS, S. M. & HEATHWAITE, A. L. (1986). West Sedgemoor: its peat stratigraphy and peat chemistry. *Proceedings of the Bristol Naturalists' Society*, **44**, 19-25

It is helpful if the text can also be submitted on a 3·5 inch floppy disk readable under MS-DOS (any version) or Windows, either as an ASCII ("text" or "print" file) or as a formatted file produced by any well-known word processing software. A formatted version is especially valuable where many scientific names are involved.

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Proceedings of the Bristol Naturalists' Society (1996), **56**:15-24.

BRISTOL & DISTRICT INVERTEBRATE REPORT, 1996

Compiled by R. J. BARNETT

City Museum & Art Gallery, Queen's Road, Bristol BS8 1RL

INTRODUCTION

The cool conditions of May, see Weather Synopsis below, led to a comment in the July/August Bulletin by John Weeks that the spring was very similar to that of 1983 when there had been a massive immigration of the Clouded Yellow butterfly. These were prophetic words indeed for, by the time they appeared in print, the whole of southern England was awash with immigrant butterflies, moths and dragonflies. However it was not the Clouded Yellow that caught the eye, although there were plenty of them, but the Painted Lady. The immigration of this butterfly was vast and subsequently there were enormous numbers of larvae reported in the summer. Migrant moths also had a superb year, a walk on Bristol Downs on an afternoon in mid-June, for example, disturbed Rush Veneer moths at almost every step. The Silver Y was also very abundant and in evidence by day. The most spectacular individual was probably the Striped Hawk-moth found by Richard Holmes at Leigh Woods.

All the activity with migrants, Bordered Straw, Vestal, Gem, *Udea ferrugalis,* Ni Moth and so on, kept members of the Bristol & District Moth Group busy. In addition this group continued to hold winter meetings (Tony Davis of the national Pyralid & Plume Recording Scheme on 17th February and a members' evening on 11th November) and monthly field meetings from March to September. One of the latter, at Folly Farm on 9th August was a joint meeting with this Society. Interesting records of resident species were received such as the Royal Mantle near Bath, the Red-belted Clearwing in Bishopston, Redland and Long Ashton, the Shore Wainscot in Whitchurch and Ruddy Carpet, *Salebriopis albicilla*, *Mecyna asinalis* and *Morophaga choragella* for example, in Leigh Woods.

The Avon Butterfly Project also continued to attract considerable numbers of records including Monarchs on Dundry and at Bristol Zoo, and confirmation that the Duke of Burgundy still clings on at one site in the Avon area. The Essex Skipper still appears to be increasing and there were a few sightings of the Pearl-bordered Fritillary in addition to those of the Small Pearl-bordered Fritillary. As well as the masses of Painted Lady sightings, over 1,000 records of Clouded Yellow were reported to the project.

With regard to diptera, it was encouraging to organise a Gordano Valley Invertebrate Group meeting with one aim being to establish whether the soldier fly *Stratiomys potamida* was still present and for B.N.S. member Simon Randolph to be able to do just that.

The Gordano Valley N.N.R. also produced a record of the splendid Musk Beetle, its only known locality around Bristol. The Rose Chafer population in the city continued to appear as adults over a very long time span, from mid-April through to mid-September. (Omitted from the 1995 report, but worth mentioning here, is that in 1995 the ground beetle *Cyminidis axilaris* (Fabr.) was found by Tony Prince at Goblin Combe, the first record outside south-east England since 1917.)

As reported last year, a small colony of the Keeled Skimmer dragonfly has been discovered in the district and although present in very small numbers at the site, continued to hold its own.

The British Arachnological Society held their A.G.M. in Bristol in March, hosted by the Bristol Regional Environmental Records Centre.

I am, as always, very grateful to those recorders who have submitted their sightings to me, and to the Bristol Regional Environmental Records Centre and their recorders. In particular, my thanks to John Weeks for submitting his annual weather synopsis and to Ted and Dave Levy for their hoverfly report and also Robert Cropper for his extensive lists and accompanying orthoptera report. Species listed below are by neccesity chosen subjectively but are hopefully of interest.

HOVERFLY REPORT (Ted and Dave Levy)

Reasonably good records this year, 111 species were recorded for vice-county 6 and the south Bristol area. The more interesting species have been selected and are listed in the species reports.

ORTHOPTERA REPORT (Robert Cropper)

Work has continued on the Somerset Orthoptera Atlas. Of special note is the continued spread of the Long-winged Cone-head *Conocephalus discolor* (Thunb.) and the discovery of a substantial population of Roesel's Bush-cricket *Metrioptera roeselii* (Hagen.) in vice-county 5 (South Somerset). Although beyond the limits of the district, it is likely that both will arrive in the area in the next year or two. Since crossing the border from Dorset, *C. discolor* has proceeded in a NW direction and may reach the district next season.

It is sad to record that we may have lost the Large Marsh Grasshopper *Stethophyma grossum* (L.) from the Levels, as no specimens could be found in 1996. It is also worth mentioning that the House Cricket *Acheta domesticus* (L.) would seem to have declined, and there have been no sightings in Somerset or the Bristol area this decade. Any records of this species would be most welcome. The species lists contain the records of most significance this year.

Recorders mentioned in the species list were as follows:

John Aldrich (JA), Rick Andrews (RA), A. Aston (AA), Mike Bailey (MB), Dr Baldwin (DrB), Ray Barnett (RB), Jerry Board (JBo), Alan Bone (AB), Des Bowring (DB), Janet Boyd (JB), Bristol & District Moth Group (BDMG), I & J Burfield (I & JB), Robert Cropper (RC), "Dixie" Dean (EAD), Judy Dickinson (JD), Roger Edmondson (RE), Martin Evans (ME), Gordano Ringing Group (GRG), Sam Hallett (SH), Dr K. Hewitt (KH), Rupert Higgins (RH), Richard Holmes (RHo), M. Hughes (MH), Carolyn Lamb (CL), Ted & Dave Levy (E & DL), Bob Lewis (RL), John Martin (JM), Cyril Matthews (CM), Nigel Milbourne (NM), Tony Moulin (TM), June Nash (JN), R. Palmer (RP), Andy Pym (AP), Simon Randolph (SR), R. & F. Skinner (R & FS), Brian Slade (BS), G. Smith (GS), Brian Trebilcock (BT), Nigel Tucker (NT), A. Wake (AW), David Warden (DWa), Darrel Watts (DW), Mr Watts (W), Jack Wimott (JW), Chris Wiltshire (CW).

Scientific nomenclature follows the checklists of Agassiz (1987), Bradley *et al.* (1972), Bradley & Fletcher (1979), Duff (1993), Fitton (1978), Kerney (1976), Pope (1977), Potts (1964), and Smith (1976).

WEATHER SYNOPSIS (by John Weeks, Yatton)

The mean temperature in 1996, 10·1°C, was the lowest since 1987, thus ending the upward trend noticed in recent years. There were negative anomalies in seven of the monthly mean temperatures from January to December, and in six of the mean maxima. The table overleaf shows that winter and spring were cold and, with the exception of February, deficient in sunshine. Overall, the six months period was rather wet. Thereafter, the summer and early autumn were warm, mostly dry and agreeably sunny - indeed, records at this station show that there were only two completely sunless days during the entire summer (one in June, one in July and none in August). Again, the general picture of rainfall over the area was distorted by a few spectacular thunderstorms, notably those on 7th June and 5th July, and another thundery spell in late August.

January ended with a cold snap which included the hardest frost of the winter, when the air minimum was -4·8° and grass minimum -10·4° on 27th. February brought more frosts (15 air, 20 ground), lowest minima -4·0° (air) on 29th and -8·0° (grass) on 4th.

March continued a high incidence of frost (17 ground) and a really cold snap at the month-end (-7·2° grass, on 30th). However day-time temperature crept above 15·5° C (60° F) for the first time in the year on 23rd.

April was unremarkable. May fell into two distinct halves - first cool and then less cool (although not yet hot, except for 30th when the maximum was 23·9°C). The month entered the record books as the coolest May since records began at this station (1979). Spring overall was the second coolest with a mean temperature of 8·3°C (it was 8·0°C in 1986). Temperatures in June rose "into the 80s" (°F) on three days and in July a hot spell commencing on 14th included five such days. Summer ended with an August which included not only the hottest days of the year, when 29°C was reached on 18th and 19th, but also the wettest day (28·9mm on 26th). After this deluge, autumn started with persistent high pressure over or near the British Isles,

which resulted in a long dry spell lasting from 26 August to 23 September - twenty-nine days with no significant rainfall.

TABLE 1. Monthly and seasonal trends in climate during 1996

	Monthly differences			*Seasonal differences*	
	Max. T°C	*% Rain*	*% Sun*	*Max. T°C*	*% Rain*
Dec. '95	-3·6	102	86		
Jan. '96	-0·9	60	37		
Feb.	-1·6	127	148	-2·1	91
March	-2·2	112	80		
April	+0·4	103	79		
May	-3·2	155	87	-1·0	121
June	+1·0	42	123		
July	+0·6	82	113		
Aug.	+0·5	169	108	+0·7	102
Sept.	+0·7	52	106		
Oct.	+1·7	107	73		
Nov.	-0·8	150	124	+0·3	116

October was pleasantly mild, if a little damp; its most memorable feature was the gale which tore through the area on 28th. November started mild, but rapidly changed to end up as the coldest since 1993, with some particularly low minima near month-end and the highest incidence of frost in this month since 1988.

SPECIES OF NOTE IN 1996

ODONATA (dragonflies)

Ruddy Darter *Sympetrum sanguineum* (Mull.) Chew Valley Lake ST55, 15 July (DWa); Weston Moor ST445734, 20 July and 3 August (DB); Lord's Wood ST6363, 24 July (DB).

Scarce Chaser *Libellula fulva* Mull. Pipley Bottom, Upton Cheyney ST7069, 19 June (female) (AP); Midford Valley ST7460, 16 July (female) (AP).

Banded Demoiselle *Calopteryx splendens* Chew Valley Lake ST55, 14 July (DWa); River Avon ST7963, 23 July (DB); Stoke Park ST618769, 27 July (DB).

Beautiful Demoiselle *Calopteryx virgo* (L.) Chew Valley Lake ST55, June and August (DWa).

Variable Damselfly *Coenagrion pulchellum* (Van Lind.) Nailsea Moor ST442696, 15 June and 30 July (DB); Tealham Moor ST4045, 10 June (RC).

ORTHOPTERA (grasshoppers and crickets)

Grey Bush-cricket *Platycleis albopunctata* (Goeze) Brean Down ST25, 21 July (RC).

Stripe-winged Grasshopper *Stenobothrus lineatus* (Panz.) Compton Dundon ST4732, 31 August (RC).

Lesser Marsh Grasshopper *Chorthippus albomarginatus* (DeG.) South Moor, Glastonbury ST5036 & 5037, 25 July (RC); Common Moor ST5041, 14 September (RC); Polsham ST5042 14 September (RC).

Rufous Grasshopper *Gomphocerippus rufus* (L.) Ebbor Gorge N.N.R. ST5248, 10 August (RC, 1st found here 12 August 1995, AW); Easton, Wells ST5147 & 5148, 17 August (RC).

DICTYOPTERA (cockroaches)

Australian Cockroach *Periplaneta australasiae* (Fabr.) Burnham-on-Sea ST3049, 20 February (BS, single found in supermarket, 1st Somerset record).

DERMAPTERA (earwigs)

Lesser Earwig *Labia minor* (L.) Brent Knoll ST3052, 25 August (RC); Backwell Common ST4970, 7 September (RC); Rolstone ST3962, 8 September (RC); Buckland Dinham ST7652, 6 October (RC); Yarberry ST3858, 1 December (RC).

Lesne's Earwig *Forficula lesnei* Finot. Felton Common ST5165, 7 September (RC).

HEMIPTERA (true bugs)

Legnotus limbosus (Geoff.) The Gully, Bristol Downs ST562749, 7 June (RB).

Eurygaster testudinaria (Geoff.) Westhay Moor ST5444, 3 August (RC).

Taphropeltus contractus (Herr.- Sch.) Meare Heath ST442402, 30 March (JB).

Coranus subapterus (DeG.) Shapwick Heath ST44, October (JB).

Nabis ericetorum Scholtz Mascall's Wood ST469536, 10 August (JB).

Heterocordylus tibialis (Hahn) Trooper's Hill, Bristol ST6273, 26 May (RB).

Lygus maritimus Wagner Ashcott Heath ST441392, 6 April (JB).

Megacoelum infusum (Herr.- Sch.) Failand ST5072, 22 September (RC).

LEPIDOPTERA (butterflies)

Essex Skipper *Thymelicus lineola* (Ochs.) Ubley Warren ST500554, 17 July (KH); Hinton Charterhouse ST767585, 24 July (JM); Draycott Sleights ST483516, (I & JB); Horsecombe Vale & Priory Wood ST7561, 31 July (GS).

Duke of Burgundy Fritillary *Hamearis lucina* (L.) near Bath ST75, 16 June (JBo).

Pearl-bordered Fritillary *Boloria euphrosyne* (L.) Priddy ST5451, 5 July (ME, RE); Chew Valley Lake ST579608, 16 June (RH); Mendip Lodge Wood ST469587, 17 June (AA).

Marsh Fritillary *Eurodryas aurinia* (Rott.) Priddy ST5451, 17 June (RP).

Monarch *Danaus plexippus* (L.) Dundry ST57, 20 July (Dr. B); Bristol Zoo ST568740, 14 September (JD).

LEPIDOPTERA (macro-moths)

Currant Clearwing *Synanthedon tipuliformis* (Cl.) Bishopston, Bristol ST589755, no date (RH).

Red-belted Clearwing *Synanthedon myopaeformis* (Borkh.) Redland, Bristol ST5874, 11 July (RE); Bishopston, Bristol ST589755, June (RH); Long Ashton Research Station ST535699, 1 August (CW).

The Vestal *Rhodometra sacraria* (L.) Bishopston, Bristol ST589755, June (RE); Stancombe, Glos. ST739977, 22 August (ME,CL).

The Gem *Orthonama obstipata* (Fabr.) Oldland Common ST670718, no date (JN, JW); Timsbury ST659587, no date (MB); Bath ST738647, no date (MB); Keynsham ST658694, October (AB); Whitchurch ST606676, July (RA); Newton St. Loe ST696642, no date (DW); Yatton ST429653, no date (TM); Keynsham ST652683, 9 October (JA), Filton ST6179, no date (AP); Clevedon ST390707, 11 June (RH, JM); Sand Point ST38658, 7 August (RH, JM); Redland ST581744, June and August (JM); Leigh Woods ST5573, 26 July (RB, AP).

Royal Mantle *Catarhoe cuculata* (Hufn.) Newton St. Loe ST696639, 15 July (DW).

Convolvulus Hawk-moth *Agrius convolvuli* (L.) Bishopston, Bristol ST589749, 27 July (NT).

Striped Hawk-moth *Hyles lineata livornica* (Esp.) Leigh Woods ST5573, 12 June (RHo).

Shore Wainscot *Mythimna litoralis* (Curt.) Whitchurch ST607676, July (RA).

Small Mottled Willow *Spodoptera exigua* (Hb.) Keynsham ST658694, September (AB); Timsbury ST659587, no date (MB); Bath ST738647, no date (MB); Blagdon ST500588, no date (NM); Stancombe, Glos. ST739977, 17 August (ME); Whitchurch ST607676, August (RA); Bishopston, Bristol ST589755, no date (RH); Sand Point ST328658, 7 August (RH, JM); Clevedon ST3970, 31 July (JM, RA); Folly Farm ST605594, 15 June (JM, RH).

Bordered Straw *Heliothis peltigera* ([D. & S.]) Timsbury ST659587, no date (MB); Blagdon ST500588, no date (NM); Timsbury ST670587, no date (CM); Whitchurch ST607676, June (RA); Yatton ST429653, no date (TM); Keynsham ST652683, 9 June (JA); Filton ST6179, no date (AP); Bishopston, ST589755, June (RH); Clevedon ST390707, 11 June (RH, JM); Avonmouth ST503782, no date (RH); Redland ST581744, June and August (JM); Sand Point ST3265, 14 June (JM).

Scarce Bordered Straw *Helicoverpa armigera* (Hb.) Timsbury ST670587, 22 October (CM); Timsbury ST659587, no date (MB); Whitchurch ST607676, October (RA); Weston-super-Mare ST318614, 8 June (MH, *per* AES Bulletin); Yatton ST429653, no date (TM).

LEPIDOPTERA (micro-moths)

Nemophora scabiosella (Scop.) Hinton Charterhouse ST768585, 24 July (JM); Radstock ST65, 1 August (AP).

Morophaga choragella (Zell.) Leigh Woods ST5573, 26 July (RB, AP).

Caloptilia rufipennella (Hb.) Redland, Bristol ST581744, 28 July (JM).

Ypsolopha mucronella (Scop.) Filton ST6179, 25 April (AP).

Mompha divisella H. - S. Clifton, Bristol ST577739, 15 April (ME); Bishopston, Bristol ST594755, 21 April (RE); Redland, Bristol ST581774, May (JM).

Epinotia demarniania (F.v.R.) Leigh Woods ST559742, 24 June (ME, JM, RH, CL, RA, RE, AP).

Aethes francillana (Fabr.) Filton ST6179, 26 July (AP).

Cochylis roseana (Haw.) Folly Farm ST608608, 9 August (MB, AB, ME, SH, CL, BT, W); Weston Moor ST446734, 19 August (JM, RH, RA, ME).

Cochylis flavicilana (Westw.) Filton ST6179, 25 July (AP).

Spatalistis bifasciana (Hb.) Lords Wood ST631632, 19 July (BDMG).

Cydia compositella (Fabr.) Northwhich Wharf ST5486, 5 August (AP).

Calamatropha paludella (Hb.) Keynsham ST658694, 2 August (AB).

Sitochroa palealis ([D. & S.]) Folly Farm ST608608, 9 August (BDMG); Oldbury Power Station ST69, 11August (JM); Portbury ST57, 12 August (RH).

Sitochroa verticalis (L.) Filton ST6179, no date (AP); Royate Hill ST617748, 17 June (JM); Whitchurch ST607676, July (RA); Bishopston, Bristol ST589755, June (RH); Eastville, Bristol ST602751, 4 July (RH).

Mecyna asinalis (Hb.) Leigh Woods ST559742, 27 June (ME, JM, RH, CL, RA, RE, AP); Clifton Down, Bristol ST57, 22 July (ME); Leigh Woods ST5574, 14 July (RL); Worlebury Iron Age Fort ST316625, 7 August (R&FS).

Salebriopsis albicilla (H.- S.) Leigh Woods ST553740, 27 June (EAD). .

Ancylosis oblitella (Zell.) Clevedon ST390705, 31 July (RA, AP, JM,RE); Portbury Dock ST503782, 12 August (RH).

Platyptilia ochrodactyla ([D. & S.]) Filton ST6179, 22 July (AP).

COLEOPTERA (beetles)

Onthophagus similis (Scriba) Bishopston, Bristol ST594755, no date (RE).

Rose Chafer *Cetonia aurata* (L.) Victoria Rooms, Bristol ST55773, 16 April (det. RB); Westbury-on-Trym ST57, 18 September (det. RB).

Oncomera femorata (Fabr.) Weston Big Wood ST4575, 15 May (ME).

Prosternon tessellatum (L.) Trooper's Hill ST6273, 26 May (RB).

Musk Beetle *Aromia moschata* (L.) Gordano Valley N.N.R. ST4372, 4 August (GRG).

Cryptocephalus aureolus Suff. Trooper's Hill, Bristol ST6273, 26 May (RB).

Cryptocephalus hypochaeridis (L.) Charterhouse ST505560, 5 July (ME, RE).

Otiorhynchus clavipes (Bonsd.) Charterhouse ST505560, 5 July (ME, RE).

HYMENOPTERA (bees, wasps & ants)

Uroceras gigas (L.) Park Row, Bristol ST57, 31 May males emerging from timber (AP).

Pompilus cinereus (Fabr.) Berrow Dunes ST2852, 28 September (RC).

Arachnospila anceps (Wes.) Berrow Dunes ST2852, 28 September (RC).

Ancistrostocerus oviventris (Wes.) Burnham-on-Sea ST3149, 6 June (RC).

Symmorphus mutinensis (Bald.) Catcott Heath ST4041, 6 July (RC).

Trypoxylon clavicerum Lep. Burnham-on-Sea ST3149, 18 June (RC).

Ectemnius continuus (Fabr.) Catcott Heath ST4041, 6 July (RC).

Ammophila sabulosa (L.) Berrow Dunes ST2852, 28 September (RC).

DIPTERA (flies)

Stratiomys potamida (Meig.) Gordano Valley N.N.R. ST4372, 14 July (SR).

Philonicus albiceps (Meig.) Brean Down ST2858, 21 July (RC).

Bombylius canescens Mik. Dolebury Warren SR4558, 23 June (RC).

Platycheirus tarsalis (Sch.) Lords Wood ST635633, 8 May (E & DL); Cleaves Wood ST758578, 25 May (E & DL).

Platycheirus ambiguus (Fall.) Lords Wood ST635633, 8 May (E & DL); Stantonbury Hill ST677637, 14 May (E & DL).

Epistrophe diaphana (Zett.) Loxley Wood ST408377, 22 June (E & DL); Shapwick Heath ST428408, 7 July (E & DL); Westhay Moor ST415423, 4 July (E & DL).

Epistrophe nitidicollis (Meig.) Kingsdon Wood ST518275, 15 May (E & DL).

Metasyrphus latilunulatus (Collin) Westhay Moor ST415423, 4 July (E & DL).

Megasyrphus annulipes (Zett.) Lord Wood ST635633, 8 May (E & DL)

Cockroad Wood ST748315, 30 July (E & DL).

Parasyrphus malinellus (Collin) Lords Wood ST635633, 8 May (E & DL); Stantonbury Hill ST677637, 14 May (E & DL).

Scaeva selenitica (Meig.) Shapwick Heath ST428408, 6 July (E & DL).

Xanthogramma citrofasciatum (DeG.) Kingsdon Wood ST518275, 15 May (E & DL).

Lejogaster splendida (Meig.) Shapwick Heath ST428408, 7 July (E & DL).

Myolepta luteola (Gmel.) Loxley Wood ST408377, 18 June (E & DL).

Sphegina verecunda Collin Ebbor Gorge ST523485, 28 August (E & DL).

Heringia heringi (Zett.) Lords Wood ST635633, 8 May (E & DL).

Neocnemodon pubescens Del. & Psch. Kingsdon Wood ST518275, 27 April (E & DL).

Pipiza bimaculata Meig. Lords Wood ST635633, 8 May (E &DL); Kingsdon Wood ST518275, 15 May (E & DL).

Criorhina ranunculi (Panz.) Lords Wood ST635633, 8 May (E & DL); Ashton Court ST555720, 2 May (E & DL); Kingsdon Wood ST518275, 30 April (E & DL).

Volucella zonaria (Poda) Filton ST6179, 28 August (AP).

Xylota tarda Meig. Cleaves Wood ST758578, 27 May (E & DL).

Nycteribia kolenatii Theo. & Mosc. Banwell Bone Cave ST3858, 1 January many on male Daubenton's Bat (RC).

MOLLUSCA (slugs and snails)

Segmentina complanata (L.) Edithmead ST3249, 25 August (RC).

Valvata piscinalis (Mull.) Cross ST4054 & 4154, 18 June (RC).

Zenobiella subrufescens (Mill.) Long Wood ST487553, 11 August (RC).

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AVON MAMMAL REPORT, 1996

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INTRODUCTION

This is the eighth recent mammal report for the former county of Avon (now the Districts of Bristol, South Gloucestershire, North Somerset, and Bath and North East Somerset). Its intention is to be a wide-ranging review of the records and studies of mammals in and around 'Avon' in 1996. The numbers of record cards received for each species and the number of one-km squares in which those species were recorded are given in brackets after the scientific name. Where no figures appear after the species name, no BNS record cards were received (however, there may have been records of that species from other sources). In cases where the records are of a sensitive nature, the four-figure grid references are omitted.

At some stage it is intended to produce a Mammal Atlas for 'Avon' and so all records of mammals are being collected. It is likely that the atlas will be based on 1-km square records (i.e. a four-figure grid reference) but records with six-figure references are preferred.

REPORTS ON MAMMALS

INSECTIVORA (hedgehogs, shrews and moles)

Hedgehog *Erinaceus europaeus* (28, 23)

Records from the following one-km squares; (all ST) 4565, 5072, 5374, 5671, 5672, 5770, 5771, 5775, 5777, 5868, 5970, 6081, 6183, 6258, 6274, 6282, 6358, 6668, 6675, 7065, 7183, 7263, 7362. As in previous years the great majority of records were of road casualties.

Of the 28 records, most were in April (5) and May (8) as they emerged from hibernation and began courtship. As expected, there were none from January to March, but it is interesting that there were three records in November and one in December, when most hedgehogs should be hibernating. This fact was also noted by Pat Morris, who, between 1960 and 1992, recorded that 6% of hedgehog road casualties occurred in the last ten weeks of the year (Morris, 1995). (Records from PJC, NL, JM, MJM, RGS, DPCT, LW).

Mole *Talpa europea* (32, 41)

There was a dramatic leap in the number of record cards received for moles as well as the number of one-km squares in which they have been recorded. Records (all of mole hills) from the following one-km squares: (all ST) 4372, 4373, 4665, 4764, 5578, 5272, 5376, 5476, 5477, 5577, 5578, 5579, 5673, 6276, 6376, 6461, 7172, 7270, 7271, 7370, 7371, 7372, 7373, 7375, 7472, 7473, 7474, 7475, 7479, 7570, 7572, 7574, 7577, 7575, 7776, 7687, 7685, 7789, 7988, 8081.

The concentration of records from 10-km square ST77 is the result of P. J. Chadwick's noting down all mammal records whilst surveying the birdlife of this square. (Records from RLB, PJC, DPCT)

Common Shrew *Sorex araneus* (3, 3)

A very under-recorded but widespread species with just three records this year from ST4372, 5658 and 6170. (Records from RMcD, RE and PF)

Pygmy Shrew *Sorex minutus* (5,6)

Individual pygmy shrews were recorded from three dormouse boxes in Kings Wood and a 'family', a female with about four babies, in a bat box at Blagdon. Other records included up to eight fighting in a hedge at Chew Valley and one dead in the road near Beach. Records from ST4564, 4565, 4664, 5259, 5658, 7070. (Records from DC, PJC, RE, RH, AR, DPCT)

CHIROPTERA (bats)

Greater Horseshoe Bat *Rhinolophus ferrumequinum* (5, 6)

North-west hibernacula: 18 on 20 Jan, eight on 6 April, 13 on 21 Oct (RDR). Ten at spring fattening-up site on 3 May and 82 adults at maternity roost on 30 June, including 4 babies (GJ). One female at Black Rock Quarry ST4574, one (active) at Burwalls ST5672, and 11 at 'Stable block' ST4766 all on 1 Nov (DC). Fifteen in ochre mine hibernacula ST4564 (6 ringed) on 20 Jan (DC, AR, AFJ, DPCT).

Kirsty Park, a research student at Bristol University began a project to monitor body temperature and arousal frequencies of hibernating bats in the Mendips to investigate how frequently bats wake up in winter and whether they travel far to feeding sites.

The Greater Horseshoe Bat is one of the nine species of mammal for which an action plan has been drawn up under the UK Biodiversity Action Plan (1995).

Lesser Horseshoe Bat *Rhinolophus hipposideros*

North-west hibernacula: 19 on 20 Jan, 26 on 6 Apr, six on 21 Oct (RDR). Seen feeding along river at Iford on 15 May (GJ). One at Black Rock Quarry, one at Brockley Coombe ST4766, three at Ashton Hill Plantation ST5270 and one at Burwalls, all on 1 Nov (DC). Ten at ochre mine hibernation site on 20 Jan (DC, AFJ, DPCT, AR); 32 at Compton Martin ochre mine on 1 Jan, 20 at Shute Shelve Cavern on 28 Jan, 11 at Dolebury Levy on 28 Jan and up to four seen in church porch at Brent Knoll in the summer (all RSC). 14 outside mine shaft at Brown's Folly Nature Reserve ST7966 on 15 May (AvonWildlife Trust).

Whiskered Bat *Myotis mystacinus*

At least eight seen leaving maternity roost at Compton Greenfield on 25 June (GJ).

Whiskered/Brandts Bat *M. mystacinus/brandti*

One in north-west hibernacula on 20 Jan (RDR).

Daubenton's Bat *Myotis daubentonii*

Male seen at Banwell Bone Cave on 1 Jan (RSC).

The Avon Bat Group (ABG) organised a survey of 12 lakes and ponds in Avon specifically to look for Daubenton's bats. The sites were visited during the summer of 1996 and Daubenton's bats were seen at six, these being Herriot's Pool ST5758, Litton/Coley Reservoirs ST5955, Eastville Park Lake ST6175, Duchess Pool ST6176 and Yate Rocks ST7185. Three lakes/pools did not have Daubenton's bats (Portbury ST4977, Motorway ST6282 and Heron's Green ST7185) and a further three proved to be inaccessible (Avonmouth ST5379, Leyhill ST6992 and Dodington ST7580). With the exception of Eastville Park Lake, all the positive observations were of very small numbers of bats. The survey continues in 1997 (Avon Bat Group *Newsletter* No. 11 Dec.1996).

Noctule *Nyctalus noctula*

Several bats seen and heard on detectors at Willsbridge Valley ST6670 on 27 July and Yatton ST4265 on 7 July (both DPCT). One on bat detector at Wick St Lawrence on 7 Aug (RSC). Several seen over Folly Farm ST6060 on 7 May (JPM). Two flying over Eastville Park Lake on 11 May (ABG and the Avon Wildlife Trust). At least four flying over woodland at Folly Farm on 9 May (PH and JF).

Brown Long-eared Bat *Plecotus auritus*

Dead bat at Radford Mill (ST6757) on 3 June, and 20 seen leaving roost at Blagdon on 27 June (both GJ). One in dormouse box at King's Wood on 28 Aug (DC). Female in Banwell Stalactite Cave on 1 Jan and two females in Sandford Levy on 28 Jan (both RSC). One in old stable block at Folly Farm, ST6160 on 19 Sept (JF).

Serotine *Eptesicus serotinus*

87 left maternity roost at Blagdon on 27 June (GJ).

Natterer's Bat *Myotis nattereri*

Male in small cave at East Harptree Coombe on 1 Jan, male in flues at Priddy on 7 Jan, one in deep crevice in Browne's hole on 7 Jan and one in Tommie's hole on 3 Nov (all RSC).

Pipistrelle *Pipistrellus pipistrellus*

55 kHz. Maternity roost counts: 202 at Chew Magna on 11 July, 232 at Wick on 17 July, 82 at Congresbury on 18 July and 83 at Bathampton on 23 July (all GJ).

? kHz. Detector records from Willsbridge Valley on 27 July and Yatton on 7 July (both DPCT); 268 emerging from the Midland Bank at Chew Magna on 17 July (PH and JF). At least three bats at Eastville Park Lake on 11 June (ABG and the Avon Wildlife Trust). Single bats in bat boxes at Chew Valley ST5760 and Blagdon ST5160 in June (both DPCT).

The Pipistrelle is one of the nine species of mammal for which an action plan has been drawn up under the UK Biodiversity Action Plan (1995).

Nathusius' Pipistrelle *Pipistrellus nathusii*

One male in 'song flight' at Blagdon on 10 Sept and one probable bat echo -locating at Chew Valley Lake (KEB, GJ). No other bats at the song flighting areas of last year (Barlow & Jones 1996).

Bat Boxes at Chew Valley and Blagdon Reservoirs

The bat boxes at Chew Valley and Blagdon were checked twice during the year, in June and again in September.

In June, the 73 usable boxes were checked revealing two with bats (a single pipistrelle in a box on a larch at Chew Valley Lake, ST5760, and a single pipistrelle in a box on an ash at Blagdon Lake, ST5160 - this second bat flew from this box to another a few metres away). Three boxes contained bat droppings and a further 11 held mammal (pygmy shrew) or bird nests (blue tit and treecreeper). (DPCT, RH and GL).

In September, for the first time since May 1992, when the boxes were erected, no bats were found in any of the 74 habitable boxes. Two boxes had a few bat droppings in them and 14 contained bird or mammal nests. Two had single eggs on the floor of the box with no nesting material - perhaps laid by blue tits that had been "taken short" on their way to their real nests? One of the boxes had three dead, nearly fully fledged, blue tits in it - it appears that they had managed to block the exit slit with nesting material and couldn't get out.

As before, a number of the boxes were full of earwigs and spiders making emptying them an interesting experience! One group of boxes at Blagdon, which has never attracted any bats, was taken down and relocated in two groups which have been more successful in the past (DPCT, RH and TC).

Bat box use by bats at Chew Valley and Blagdon Lakes to date has been limited, with between 3% and 14% being used each year (Table 1). There is some evidence that once bats have found a box, they will use it repeatedly. In the four years the boxes have been in place, 19 have been used by bats. Two boxes have been used in all four years, two in three of the four years, two in two of the four years and twelve in only one year. Between 10% and 19% of the boxes are used as nest sites by birds and 'other mammals', a habit likely to deprive bats of potential roost sites. There was however, one occasion when fresh bat droppings were found on top of a bird's nest!

A similar bat box project in a suburban woodland in Hertfordshire had a box usage rate of between 2.5% and 10% over a period of five years. As with the Chew Valley and Blagdon sites, all the bats recorded were pipistrelles (Herbert 1992).

Bat Studies at University of Bristol

A study by Nancy Vaughan, Gareth Jones and Stephen Harris and a number of volunteers showed how the activities of different species of bats are affected by outputs from sewage treatment works (Vaughan *et al.,* 1996). The study involved assessing bat activity ('bat passes') and attempted prey captures ('feeding buzzes') upstream and downstream of 19 treated sewage outflows into rivers and streams in Avon, West Wiltshire and North Somerset.

TABLE 1. Bat box use by bats, other mammals and birds at Chew Valley and Blagdon Reservoirs, 1992-1996. All bats found to date have been Pipistrelles *P. pipistrellus*.

nr - not recorded; * only 44 boxes checked owing to wet weather

Date	*No. of usable boxes*	*No. with bats present*	*No. of bats found*	*No. with bat droppings only*	*Overall % of boxes used by bats*	*No. (%) with bird/mammal nests*
Spring 1992	73				-	
Spring 1993	72	2	2	nr	>3%	7 (10%)
Autumn 1993	71	2	4	8	14%	8 (11%)
Spring 1994	67	1	1	4	7%	13 (19%)
Autumn 1994	76	2	11	1	4%	12 (16%)
Spring 1995	75	1	1	4	7%	14 (19%)
Autumn 1995*	77	3	9	2	6%	9 (12%)
Spring 1996	73	2	2	3	7%	11 (15%)
Autumn 1996	74	0	0	2	3%	14 (19%)

Over 5000 'bat passes' were recorded, 9.7% by *Nyctalis* species (serotines etc.), 47% by *Myotis* species (mainly Daubenton's bats), and 43.3% by pipistrelles (36.5% by 45 kHz bats, 62.6% by 55 kHz bats and 0.9% by unknown kHz bats). Overall bat activity and foraging activity were significantly reduced downstream of sewage outflows (by 11% in 'bat passes' and 28% in 'feeding buzzes'). Both phonic types of pipistrelle were less active at downstream sites than at upstream sites. The 45 kHz bats were shown to concentrate their efforts at upstream sites, whilst *Myotis* bats (Daubenton's) were found to forage at higher rates downstream of outflows. It was concluded that the maintenance of high standards of water quality may be important for the conservation of Pipistrelles. *Myotis* bats may, however, be able to benefit from eutrophication.

Allyson Walsh and Stephen Harris reported on the national survey of bats and their habitats carried out over three consecutive summers from 1990 to 1992 (Walsh & Harris 1996). Over 1,000 randomly selected 1- km squares (stratified to cover all 32 land classes defined by their geology, altitude, climate and land use) were visited by volunteer bat group members armed with bat detectors tuned to 45 kHz on four occasions each year. All bat passes (bats flying past and feeding 'buzzes') picked up on the detectors, together with details of the weather and habitat/vegetation type were recorded on large-scale maps.

Detailed analyses of the data showed that habitats associated with broad-leaved woodland and water were most preferred, whilst arable land, moorland and improved grassland were strongly avoided. Linear features such as hedgerows, ditches, tree lines etc. were selected in all landscape types. It was concluded that management

policies for bats in Britain should aim at preserving and enhancing the availability of woodland, water margins and linear corridor habitats.

LAGOMORPHA (Rabbits and Hares)

Brown Hare *Lepus europaeus* (10, 10)

Records from Walton Common, ST4272 (RGS), Gordano Valley NNR, ST4372 (DPCT, RMcD), Wilmington, ST6862, Marksbury Vale, ST6662 and Tucking Mill ST6664 (all PF), Hinton ST7276, West Littleton area ST7574, ST7577 and ST7675 and Marshfield ST7875 (all PJC). Other records from Jo Ferns of the Avon Wildlife Trust from the following areas: Blake's Pools ST3766 (one in April and for past three years), Cadbury Farm ST4264 (two in March and one in June), Kenn Moor ST4367 (five in May), Kingston Seymour ST4068 (one in Sept.), Walborough ST3157 (date unknown), Dowlings Wood ST6160 (one seen on several occasions over last four years), Oldbury Power Station ST6094 (date unknown), Weston Big Wood ST4575 (2 in the spring of 1990-91), Portishead Down ST4575 (one possibly in early August), Sheepway ST4976 (four-five in summer), ICI Severnside ST5483?, and Locking Moor Road (two in September).

Ruth Temple of the University of Bristol, researching into the conservation of brown hares, used records gathered by members of Bristol Naturalists' Society, the Avon Wildlife Trust and other mammal recorders throughout the South-west to attempt to establish current population trends. Brown hare numbers have declined to about 20% of those present at the beginning of the century, and therefore this is one of the nine species of mammal for which an action plan has been included in the report of the UK Biodiversity Steering Group (1995) (*pers. comm.*, Ruth Temple).

The report on the National Brown Hare survey, carried out in the winters of 1991/92 and 1992/93, was published in 1996 (Hutchings & Harris 1996). The survey concluded that the current British brown hare population was estimated to be 817,520 +/- 37,251 adults in mid-January, compared to an estimated mid-winter population of 4 million hares in 1880. There was a definite east/west divide in hare distribution, with 60.3% of the population in arable areas, 23.5% in pastoral areas, 10.8% in marginal upland areas and 5.4% in upland areas. Nearly 20% of the hares were found in just three counties (Cambridgeshire, Norfolk and Suffolk), which constitute only 5% of the land area of Britain.

Rabbit ***Oryctolagus cuniculus*** (24,48)

Records from the following 1 km squares: (all ST) 3869, 4271, 4372, 4373, 4374, 4472, 4473, 4673, 5175, 5276, 5578, 5861, 6261, 7067, 7070, 7071, 7077, 7171, 7263, 7270, 7271, 7272, 7370, 7371, 7372, 7373, 7471, 7472, 7474, 7475, 7478, 7479, 7560, 7561, 7570, 7572, 7577, 7670, 7672, 7679, 7687, 7757, 7770, 7776, 7778, 7879, 7970, 7973, 7974, 8081, (records from DPCT, PJC, S and JGP, RGS, HER, JFB, RMcD and RLB)

Rabbits with myxomatosis were seen in the Gordano Valley ST4374 in April (RGS).

In March 1996 the Ministry of Agriculture Fisheries and Food (MAFF) proposed the removal of statutory controls on Viral Haemorrhagic Disease (VHD) of rabbits. These controls, which were brought in in 1991, required anyone who had in their

possession a diseased or suspected diseased rabbit or carcass to notify the Ministry. The County Wildlife Trusts and the Mammal Society were critical of MAFF's proposals to end the status of VHD as a notifiable disease as there would no longer be any means of recording its spread. They estimated that VHD will kill about 50% of this country's rabbits, with unknown consequences for predators such as buzzards, polecats and red kites and for habitats which are dependant on rabbit grazing ('Ministries pass the buck over rabbits', *Natural World,* Autumn 1996 and 'Rabbit Disease', *Mammal News*, 106).

RODENTIA (rats, mice voles and squirrels)

Brown Rat *Rattus norvegicus* (7, 7) and **House Mouse** *Mus domesticus*

Richard Bevan of Bristol City Council Pest Control Services reported (*pers. comm.*) increases in notifications of both brown rats and house mice in 1996. Compared to 1995, rat notifications increased by 23% to 1,176 and mouse notifications increased by 4% to 1,876. No problems with resistance to rodenticides were reported.

Brown rat records from ST5377, 5384, 5777, 6071, 6170 and 6463 (records from RE, PF, DC, MJM, SP). Susan Prince reported seeing two adults, one carrying a baby in its mouth, at Severn Beach in July - perhaps they were moving house?

Grey Squirrel *Sciurus carolinensis* (45,45)

There appears to have been a dramatic leap in the number of squirrel records for 1996. Records from the following 1 km squares (all ST) 4172, 4372, 4459, 4465, 4564, 4666, 4758, 4858, 4877, 5159, 5160, 5269, 5476, 5477, 5560, 5562, 5571, 5572, 5574, 5575, 5577, 5578, 5664, 5672, 5673, 5677, 5678, 5771, 5775, 5776, 5777, 5778, 5869, 5873, 5876, 6075, 6165, 6170, 6377, 6664, 6670, 7164, 7660, 7862, 7863 (records from PJC, JFB, RGS, DPCT, RE, RH, MJM, SP, PF, RLB). John Burton reported a reduced number of grey squirrels in the Sheep Wood area of Westbury-on-Trym after a 'cull' by the local authority.

Dormouse *Muscardinus avellanarius*

Regular dormouse surveys continued at King's Wood (DC), Leigh Woods (AR) and Dowling's Wood (Avon Wildlife Trust) during 1996. 'Dormoused' hazel nuts were found at Burrington Ham ST4858 in May (JPM). Dormice even managed to hit the local newspaper headlines: 'Trees felled to help dormice' (*Bristol Evening Post,*12 November) - an item about the reintroduction of coppicing to Leigh Woods/Avon Gorge National Nature Reserve.

The results of the 1993-4 'Great Nut Hunt', part of English Nature's Species Recovery Programme, were published in 1996 (Bright *et al.,* 1996). Nationally nearly 6,500 people participated, sending in 13,171 hazel *Corylus avellana* nuts. Of these 1,352 (10.3%) were confirmed as having been opened by dormice, 1190 (9%) by woodmice, 1091 (8.3%) by bank voles, 8323 (63.2%) by squirrels and a further 1215 (9.2%) could not be determined. A total of 334 sites with dormice were identified in England and Wales. In Avon, 34 sites were visited and a total of 2,833 opened hazel nuts submitted for examination. Of these only 12 nuts were confirmed as having been opened by dormice, these coming from four sites, in the Kings Wood/Cleeve

and Lower Woods (Hawkesbury) areas. Table 2 summarises the data for the counties surrounding 'Avon'.

TABLE 2. Hazel nuts and Dormice in Gloucestershire, Somerset and Wiltshire

County	*Sites visited*	*Sites with dormice*	*No. of hazel nuts submitted*	*No. of 'dormouse' nuts*
Gloucs.	54	7	4,520	18
Somerset	73	30	5,877	143
Wiltshire	56	14	4,039	60

The Gloucestershire records were concentrated in the Forest of Dean and Dursley areas, the Wiltshire sites in the Great Ridge/Grovelly Wood, Ludgershall, Savernake and North Wraxall areas and the Somerset sites in the Cheddar, Exmoor, Stapleford Fitzpaine and Hardington areas.

The dormouse is one of nine species of mammal for which an action plan has been drawn up under the Report of the U.K. Biodiversity Action Plan Steering Group (*c.*1995).

Water Vole *Arvicola terrestris* (2, 2)

Only two records for 1996, at Avonmouth Rugby Club ST5377 where three were seen on 24 July (DC) and at Lawrence Weston ST5379 (PF).

Rob Strachan of the Wildlife and Conservation Research Unit at the Department of Zoology, University of Oxford (WildCRU), in association with county Wildlife Trusts and mammal recorders, began a detailed national survey of water voles, the aim being to estimate their present distribution and to find evidence for their recent dramatic decline ('Water Vole Sanctuaries', *Wildfowl and Wetlands* no.116, Summer 1996).

David Macdonald reported on a study carried out in 1995 by WildCRU, involving revisiting 130 sites on the River Thames catchment which had been surveyed in 1990. 73% of the sites were occupied by water voles in 1990 but this had declined alarmingly to only 23% by 1995. Mink presence had increased from 24% to 46% of the sites in the same period. Of the 60 sites where mink were seen there was no trace of water voles. However, water voles had begun to decline before the arrival of the mink. Other factors identified in the decline of 'ratty' included the degradation of areas of marshy reed-beds alongside rivers into fragmented ribbons of habitat, increased flooding, increased cattle grazing of river banks, pollution and competition from brown rats ('Ratty on a tight-rope', *BBC Wildlife* **14** (2) Feb.. 1996).

The water vole is one of nine species of mammal for which an action plan has been drawn up under the UK Biodiversity Action Plan.

Harvest Mouse *Micromys minutus*

Rachel Parker, Andrew Cadwallader and John Martin of the Avon Wildlife Trust took part in a national survey of harvest mice co-ordinated by the Mammal Society.

The survey used modified tennis balls as a monitoring technique. Each ball had a hole 16 mm in diameter cut into the side, and was filled with hay and bird-seed. The balls were then attached to bamboo canes at a height of between 30 and 60 cm above the ground and placed in suitable habitats in early June. A total of 50 balls were placed at each of two sites, Weston Moor ST4473 (reed bed) and Chew Valley Lake ST5758 (the inter-face between rank grassland/tall herbs and reed bed). The balls were then checked in late August for the presence of harvest mice (signs of use would include nests, droppings, chewed/nibbled seed etc.). At the Chew Valley site 39 balls were relocated, of which 18 showed signs of use by harvest mice. A grass nest was also found near one of the tennis balls.. The results from Weston Moor were less conclusive with possibly two or three balls showing signs of use (John Martin, *pers. comm.*).

In the autumn of 1996, as a follow-up to the 'tennis ball' survey, and as part of the 'Look out for Mammals' initiative, the Mammal Society began a re-survey of a number of sites where harvest mice were known to have been present in the mid 1970s. Between 1960 and 1974 the species was recorded from 39 one-km squares in North Somerset (Vice-county 6) and from 28 one-km squares (all records gathered between September 1973 and December 1974) in West Gloucestershire (Vice-county 34). The species was said to be 'common, particularly on the peat moors of the Somerset Levels where suitable habitat abounds'. Several records were from the southern scarp and plateau of the Mendips up to an altitude of 260 m, amongst the highest colonies then known in the British Isles. Harvest mice were found to be fairly common in the southern part of West Gloucestershire, with most records from hedgerows bordering arable fields or from roadside verges, including two records from the embankments of the M4 (Harris & Symes, 1975).

Initial indications are that nationally, there has been a dramatic decline in harvest mouse numbers. Nearly 250 sites throughout England and Wales were re-visited and harvest mouse nests were found at only 28%. There has also been a worrying loss of 'suitable habitat' at 24% of the sites (Gillie Sargent and Shirley Pottie, *Mammal News* No. 109). Eleven sites in the West Littleton/Dyrham area were re-surveyed in December and no evidence of harvest mice was found (DPCT).

A probable harvest mouse nest was found in a *Molinia* grass tussock in the Gordano Valley NNR ST4373 during the autumn small mammal trapping session.

The Mammal Society National Field Vole Survey continued during 1996. The Gordano Valley National Nature Reserve site ST4373 was trapped using Longworth live-capture traps in the spring and the autumn. The 1996 results, together with those from previous years, are summarised in Table 3.

Bank voles appear to be making somewhat of a recovery from their population crash in the spring of 1995. Field voles continue to be present although at a relatively low density. Woodmice continue to thrive, with their spring numbers being particularly high. This contrasts with the trapping data from a hedge studied in north Avon which consistently had high numbers of woodmice in the autumn and low numbers in the spring (a total of 105 animals were caught between autumn 1984 and autumn 1989, compared to a total of only 22 animals in the spring) (Trump 1991).

Shrews appear to have become locally extinct or have become very 'trap-shy'. They have however been seen and heard regularly in the vicinity (Robbie McDonald, *pers. comm.*). Nationally, 10 other sites were surveyed in the spring and eight in the autumn with varying degrees of success (Michael Woods, *pers. comm.*).

TABLE 3. Small Mammal Trapping in the Gordano Valley NNR, 1994 to 1996

	Field Vole *Microtus agrestis*		Bank Vole *Clethrionomys glareolus*		Woodmouse *Apodemus sylvaticus*		Common Shrew *Sorex araneus*
Season	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Both sexes*
Autumn 1994	3	1	26	0	11	0	5
Spring 1995	3	0	8	0	6	0	1
Autumn 1995	3	0	2	3	16	21	0
Spring 1996	7	0	2	0	24	7	0
Autumn 1996	2	2	14	8	19	25	0

Apart from those during the Field Vole survey, the following 'small mammal' records were received in 1996:

Yellow-necked Mouse *Apodemus flavicollis* (1, 1)

A male weighing 42g found in a dormouse box in Kings Wood on 20 Oct (DC).

Bank Vole Clethrionomys glareolus (2, 2)

A record of one at Ashton Court ST5471 (RE). Longworth trap records from the Gordano Valley ST4373 (see above).

Short-tailed Field Vole *Microtus agrestis* (4, 4)

Burrows and tunnels in rough 'set-aside' grassland at Chelwood ST6461 (DPCT), Royal Portbury Dock ST4877 (nest under plank of wood on 4 Oct) (RE) and a group of four seen in allotments at Brislington ST6170 on 30 May (PF). Longworth trap records from the Gordano Valley ST4373 (see above).

Woodmouse Apodemus sylvaticus (8, 5)

Single male in a dormouse box on 23 Mar and three in dormouse boxes (c. 1.0 - 1.3 metres up trees) on 20 Oct all at Kings Wood (DC). One caught in new-style small-mammal trap (*Long Meadow*) in the MAFF carpark in Westbury-on-Trym ST5778 on 25 Oct (JP/DPCT). One brought in by cat ST5777 on 21 Jun (SP/JGP). One seen running from under bird feeder to greenhouse at Clevedon ST4172 on 14 April (RGS). Longworth trap records from the Gordano Valley ST4373 (see above).

CETACEA (whales, dolphins and porpoises) and PINNIPEDIA (seals)

A dead **Common Porpoise** *Phocoena phocoena* was found washed up on the beach near Oldbury Power Station ST5994 in May (DB).

A **Bottle-nosed Dolphin** *Tursiops truncatus* was seen jumping almost totally clear of the water on 3 March at Sand Point (JPM).

An unidentified dolphin was regularly seen near the second Severn crossing (RM).

Grey seals *Halichoerus grypus* continue to be spotted in the Severn estuary off the coast of Avon, with sightings off Wain's Hill, Clevedon on 14 April (HER) and further off shore on 16 July (RM).

Following the discovery in 1994 of previously unrecorded *Brucella* organisms in seals, dolphins and porpoises in waters around Scotland, MAFF issued a reminder to those 'professionals' dealing with seals and small cetaceans of the need to take necessary precautions, and for the public not to handle any marine mammals, to prevent risk of infection (MAFF News Release 186/96 June 1996).

At the 48th International Whaling Conference in Aberdeen in June, the UK Government continued to oppose any moves to end the current moratorium on commercial whaling (MAFF News Releases 159/96 and 219/96 June 1996).

CARNIVORA (carnivores)

American Mink *Mustela vison* (2, 3)

Records from Blagdon Lake ST5358 (WGB), Backwell Lake ST4769 (GA) and the Gordano Valley area ST4372 (RMcD).

Stoat *Mustela ermina* (3, 3)

Seen on several occasions in the Gordano Valley NNR ST4372 (RMcD). Other records from the Walton-in-Gordano area ST4273 and 4172 (both RGS).

Weasel *Mustela nivalis* (4, 4)

A single animal seen running across the road south of Puxton ST4062 (JB); others seen near Horton ST7784 (PJC), Filton ST6179 and Lawrence Weston ST5379 (both RE).

Robbie McDonald of the University of Bristol continues with his PhD studies of the changes in stoat and weasel numbers locally and nationally.

Otter *Lutra lutra*

The report on the Third Otter Survey of England, 1991-94 was published in 1996 (Strachan & Jefferies 1996). The recovery of the English otter populations suggested by the 1984-86 survey was confirmed by the new survey with 'highly significant' increases in site occupancy in seven of the ten National Rivers Authority (NRA) regions, including Severn Trent. The increase in the Wessex region was 'probably significant' and the Thames area showed a 'small but non-significant upward change'. The nearest wild otters to 'Avon' in the 1991-94 survey were shown to be on the R. Frome, below Stroud and on the Cam, near Slimbridge in Gloucestershire, and on the Brue, Parrett and Tone in Somerset. In July 1990, a pair were released by the Otter Trust on the By Brook, a tributary of the middle reaches of the Bristol Avon. Signs were still being found close to the release site in 1992.

According to the survey, otter numbers in Devon have increased by 50% since the mid 1980s, whereas mink numbers have halved. The likely explanation of the decline in mink numbers is 'lethal fighting and predation by otters' according to Dr. Jefferies, one of the report's co-authors. It is unlikely that mink will be eradicated by otters, the likeliest scenario being that the two species will eventually co-exist with

mink numbers much reduced ('Tarka's Revenge' *BBC Wildlife Magazine,* **14** (7) July 1996). This could offer a life-line to the beleagured water vole?

Badger *Meles meles* (23,30)

Records from the following 1 km squares : (all ST) 4172*, 4272*, 4373, 4472*, 4664, 4761*, 5472*, 5561, 5571*, 5574, 5578, 5675, 5662*, 5671*, 6477*, 6790*, 7071, 7177*, 7775***, 7863*, 7077*, 7573**, 7476*, 7673, 7675, 7474, 7476, 7972, 8081, (* = road traffic casualty record) (Records from PJC, RGS, DPCT, RH, AR, DC, JMM, RE, PB, SC, RMcD).

There appear to be two main periods in the year when badgers are prone to being run-over, April/May and September/October (Figure 1). The spring peak coincides with the peak in territoriality (early spring) and mating season (from February/May) and the early autumn peak is likely to coincide with the dispersal of cubs from the territories and setts in which they were born (Corbet & Harris, 1991).

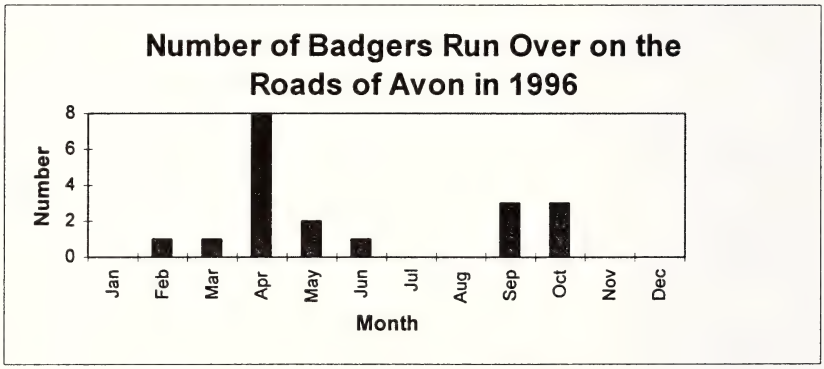

FIGURE 1. Numbers of Badger Road Casualties in Avon, 1996

It is widely believed by farmers and landowners in the south west that the badger population has continued to increase from the UK population estimate of 250,000 adult badgers in the mid 1980's. In October 1995 the National Farmers Union published a report calling for a change in the law to allow farmers to resume badger culling to reduce 'excessive environmental and agricultural damage'. If the reported rise in badger numbers is correct it may demonstrate that persecution had an even greater impact on badger numbers than conservationists appreciated ('Wet Blankets spoil badgers' big comeback' *BBC Wildlife Magazine* **14** (1) Jan. 1996.)

The badgers and bovine TB debate continued unabated, ('Badgers linked to TB time-bomb', *Farmers' Weekly;* 'Badger TB enquiry "Cop-out", says angry SW', *Farmers' Weekly,* 26 July, 'The Farmer, the Dairy Herd and Mr Brock' *Country Living,* March). The Agriculture Departments announced a third independent review into the government's policy on bovine tuberculosis in cattle and badgers, under the chair-manship of Professor John Krebs, Chief Executive of the Natural Environment

Research Council. The report is due in early summer 1997 (MAFF News Release 269/96 23 July).

TB levels in the south-west of Britain are increasing at an alarming rate. In 1995, 316 new cattle herds in the south-west were confirmed as having TB and 2,431 cattle were slaughtered. It is expected that around 350 new herds will have been infected by the end of 1996. The 'live TB test' which could only detect about half the infected badgers has been abandoned in favour of the previous non-selective slaughter strategy. The Labour Party announced that they would introduce a moratorium on badger culling if they were to be elected at the general election ('MAFF intensifies TB Muddle', *BBC Wildlife Magazine,* **14** (12) Dec.1996).

Fox *Vulpes vulpes* (27,24)

Records from the following 1 km squares : (all ST) 4373, 4767, 5068, 5371, 5675(a), 5776(b), 5778(c), 5861, 5876(d i-iv), 6165, 6286, 6579, 6588, 6791, 6877, 6977, 7183, 7472, 7572, 7673, 7774, 7859, 7864, 7974 (records from DPCT, RE, RGS, PB, A and SK, PJC, PF, S and JGP, MJM, RMcD, JM, CB, JPM).

February 1996 marked the end of an era in Bristol with the death of 'Friendly', the last of the 49 foxes being intensively studied by Phil Baker, Stephen Harris and Stephan Funk at Bristol University. Ironically, Friendly did not die from mange but was run over. Mange arrived in Bristol in June 1994 and within 18 months had wiped out almost all of the city's world-famous urban foxes. In the five years preceding the arrival of mange, fox group size had been rising steadily from just over two adults per group in 1991 to six in 1994 with up to three generations present in each social group. Territory sizes were amongst the smallest ever recorded. The small territory size resulted from the availability of vast amounts of food available (10% of households put out food for foxes, the hand-outs forming just over half the foxes' diet). With the demise of whole groups of foxes, the survivors expanded their territories by as much as six-fold in the space of a few months. These increases in territory size meant that foxes were crossing more unfamiliar roads, hence Friendly's unfortunate demise ('Foxy come home', *BBC Wildlife Magazine* **14** (7) July 1996).

Despite the devastation, foxes are survivors, rapidly recolonising suitable areas, and it is unlikely that we have seen the last of 'our' famous foxes.

Fox records from within the city boundary in 1996 include the following:

(a) one by St Mary's Church, Sneyd Park ST5675 in April (PB),

(b) a 'scruffy' fox with a collar, in January in Henleaze Park Drive ST5776 (A & SK),

(c) one seen on three occasions in Westacre Close ST5778 during the year (CB),

(d) (i) 'scruffy' fox being mobbed by crows and gulls near the YMCA ST5876 in February (A & SK),

(d) (ii) one seen in Hill Burn, Henleaze ST5876 in October (SK),

(d) (iii) one seen near Claremont School ST5876 in October (SK),

(d) (iv) one seen in The Crescent, Henleaze in November (SK).

Other unconfirmed sightings at the end of the year from Bishopston and Redland (JPM).

ARTIODACTYLA (deer)

Red Deer *Cervus elaphus* (1,1)

An unconfirmed record of a red deer swimming across the river Avon in the Avon Gorge ST5674 in March/April (seen by the peregrine observers). It is likely that this was an escapee from a nearby deer farm (see 1995 Avon Mammal Report).

Roe Deer *Capreolus capreolus* (25,21)

Records from the following areas: Gordano Valley ST4372 and 4373, Kings Wood ST4564, 4565, 4664 and 4665, Leigh Woods ST5574, Avon Gorge ST5674 (swimming across the river), Hursley Hill ST6165, Chelwood ST6461, Lansdown ST7169, Cold Ashton ST7372, Dyrham Wood ST7373, Dodington/West Littleton ST7477, 7575, 7578, 7675, 7679, and 7776, Marshfield ST7872 and 7974 and Tormarton ST7978 (records from DPCT, PF, RE, AR, DC, RH, PJC, RJW, RMcD and the Peregrine observers). A blue tit nest made out of roe deer fur was found in one of the Kings Wood dormouse boxes.

Muntjac *Muntiacus reevesi*

A possible 1995 record of a Muntjac. "Oh Deer! Did you see it?" (*Bristol Observer,* 14 July 1995). A resident of Canberra Grove, Filton ST6079 saw a small deer 'the size of a dog' in their garden at around midnight on 4 July.

Deer Parks

There are several deer parks and farms in the Bristol area, some of which are open to the public:

TABLE 4. Deer parks and farms in the Bristol area.

Name	*Grid Ref.*	*Species*
Brockley	ST4767	?Red
Ashton Court	ST5571	Fallow and Red
Whitcliff Park	ST6797	Fallow and Red
Dyrham Park	ST7475	Fallow
Claverton	ST7864	Fallow

LEGISLATION

The **Wild Mammals (Protection) Act, 1996** became law in February. The act makes it an offence for any person to mutilate, kick, beat, nail or otherwise impale, stab,

burn, stone, crush, drown, drag or asphyxiate any wild mammal with intent to inflict unnecessary suffering.

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BRISTOL BOTANY IN 1996

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A notable feature of the weather of 1996 was the very low rainfall. Although more than 0·2 mm of rain fell on 164 days of the year, the total rainfall was only 781 mm, 89·1% of the long-term (1961-1990) average. This was the lowest annual rainfall since 1978 (which was only slightly drier), being a little lower than the very warm 1990. Distinctly dry months were January, June, July, September and December, these five months overall having rather less than half the average rainfall; in contrast, notably wet months were October and November. Temperatures for the year were close to normal, especially the mean minimum temperature, but the mean maximum temperature of 13·0°C was 0·7°C lower than average (all meteorological records relate to Long Ashton Research Station). February, March, May and December were cold months, but July and August warmer than average. Unlike 1994, when there were no ground frosts at all in November, there were 8 in that month in 1996, with a total of 52 for the year.

The vernal flora was good but, contrasting the situation in many recent years, was rather late. *Helleborus foetidus* on Churchill Batch and in Goblin Combe did not come into flower until about mid-February and snowdrops were still in bud at about this time in Compton Martin Wood, a north-facing site. *Primula vulgaris* and *Ranunculus ficaria* were first seen in bloom in Cheddar Wood in early March. *Helleborus viridis* on Failand Hill was starting to flower on 9 March, but was still in bud in its Mendip localities. At this time there was a fine display of *Hornungia petraea* in Leigh Woods, but it was very late on Mendip. As in 1995, there was striking flowering of *Gagea lutea* at Stoke St. Michael, but it was nearly a month later than in 1995 (all records RSC).

On 8 August 1996, MARK, CK, LH and ACT celebrated the 150th birthday of J. W. White — whose *Flora of Bristol*, published in 1912, was a landmark in its time and has been an extremely valuable source of reference ever since — by a field day. White's grave in Canford Cemetery was easily found, but appeared rather neglected. Besides looking at *Tilia platyphyllos* in the Gorge, the party saw this tree also near Shirehampton; on the return journey of the group a cluster of several trees of *Sorbus domestica* was found on a riverside cliff, this being a second record for vice-county 34, there being also other notable finds. The considerable success of this foray has prompted a repeat of a celebratory 'White's Day'.

An account of *Sorbus latifolia* (Lam.) Pers., the Service Tree of Fontainebleau, by PJMN, who identified a sapling of this at a meeting of the Montgomeryshire Field Society in 1995 at Llanymynech Rocks (a third record for Montgomeryshire), is

given in the Montgomeryshire Field Society's *Annual Report and Notes 1995,* pp. 19-20, published in 1996. An illustration of the type specimen, held in Paris, is included. This tree has regenerated on both sides of the Avon, being bird-sown from gardens. After the workshop on the status of *Sorbus* in the UK held at Wakehurst Place in April 1996 (report not yet published), the Gully of the Avon Gorge was surveyed for *Sorbi* in the autumn, leading to the report in September 1996 by T. C. G. Rich and L. Houston, entitled 'The *Sorbus* Survey of the Gully, Avon Gorge'.

During the year much cleaning of the Gorge from the toxic abrasive grit used in shot-blasting the Clifton Suspension Bridge in 1995 was undertaken. The hazardous and difficult removal of the metallic slag deposit (high in copper and zinc) involved workers being lowered on ropes in the most precipitous parts, and the use of trowels, brushes and low-pressure air hoses. The work was almost complete by the end of the year. Not surprisingly, bare areas result; careful documentation of the restocking and the hoped-for recolonisation of these areas is desirable. An article on the plant rescue was published in the *Bristol Evening Post* of 4 July 1996.

As in previous years, many records show further localities for less common species, new occurrences of hybrids and fresh establishment of alien species, including several garden escapes (e.g. *Rosa glauca*) which have not previously been reported in the Bristol area. Of considerable note is the first record of *Euphorbia paralias* for v.c. 34 and the second record of *Sorbus domestica*, as already mentioned. The re-occurrence or long persistence of species in localities from which they had not been reported for many years is well exemplified by the record of *Ophrys insectifera* on the City side of the Avon Gorge, and of *Bupleurum tenuissimum* in the saltmarsh at Sea Mills (both unrecorded for much more than a century). In contrast, it seems that the hybrid *Ophrys insectifera* × *O. apifera* has been lost from Leigh Woods.

An interesting assemblage of plants by the New Pill Gout, in the Severnside Works area, **G,** has been examined by PJMN. The Red Rhine runs its last 200m deeply through the riverside grassland and then out to the mudflats of the Severn. Within and beyond the rhine are many decaying timber uprights 1 to 4m high, being part of an abandoned fishing structure. To landward, where the adjacent banks give shelter, some of these timbers, especially their upper parts, support a sparse halophyte flora of *Aster tripolium* L., *Cochlearia anglica* L., *Plantago maritima* L., *Puccinellia maritima* (Hudson) Parl., *Tripleurospermum maritimum* (L.) Koch and *Salicornia.* The tidal waters of the Severn regularly reach the timbers, bringing water and silt to the plants.

Published in October 1996 was the 'Revised List of Scarce Plants of the Avon Gorge and Environs' by L.C. Frost, being the *University of Bristol Avon Gorge Project Report No. 20.* This report discusses and gives details of seventeen native plants known from 1970 onwards and of the native species lost before 1970 as well as of casuals and garden escapes and of species in the not-so-scarce category.

Issued early in 1996 was a facsimile reprint of the text and woodcuts of Parts II and III of *A New Herball* by William Turner, originally published in 1562 and 1568 respectively. This reprint, with additional matter, edited by G. T. L. Chapman and others, was published by the Cambridge University Press. The reprint of Part I of

1551 was published by The Mid Northumberland Arts Group and Carcanet Press in 1989. Turner, 'The Father of English Botany', was Dean of Wells from 1551 until his death in 1568 but was in exile during the reign of Queen Mary (1553-1558), returning in 1561. Part I of the *Herball* notes Rustyback Fern at Bristol and Meadow Saffron at Bath; Parts II and III give many more plant records from Somerset, some localised to particular towns and villages. Turner interestingly refers to *Myrica gale* as a 'Fen shrub or bush called Gall ... in Somersetshire Goul or Golle ...'. Unfortunately, the famous Bristol record of honewort (*Trinia glauca*) in Turner, starting in title 'Of the herb called *Peucedanum*' and in the main text 'I hear say that it groweth also in England, and I found a root of it at Saynt Vincentis rock, a little from Bristow. But it was nothing so great as it of Germany.' is given incorrectly in the new text as *Peucedanum officinale* (Hog's Fennel), a much taller rare plant, in Britain restricted to Essex, Kent and Suffolk.

The Society mourns the loss of Miss Florence Gravestock who died on 9 December 1996, aged 88. She joined the BNS in 1949 and the BSBI in 1959. She had a long record of service to the BNS, being botanical secretary from 1961 to 1978; she was elected to honorary membership in 1979. Miss Gravestock was much involved in conservation in the Bristol area and was a regular contributor to '*Bristol Botany*', especially of plants around the Stoke Bishop area (notably Sea Mills and Shirehampton) and on Mendip, her last record in September 1996 being a hybrid thistle on Durdham Down. She maintained a long interest in the genus *Hedera* (her first Christian name was Ivy!) and she made the first authentic record of *Atriplex longipes* for Bristol, although well down-river from the Avon Gorge, at Shirehampton (*Bristol Botany in 1977*, p. 20). An obituary is given on pp. 9 – 11.

Names of contributors associated with several records, or with the determination of specimens, are abbreviated thus:

SHB	S. H. Bishop	CK	Mrs C. Kitchen
PJC	P. J. Chadwick	MARK	M. A. R. Kitchen
EJC	E. J. Clement	JPM	J. P. Martin
CJC	C. J. Cornell	DM	Mrs D. Maxwell
RSC	R. S. Cropper	PJMN	P. J. M. Nethercott
IPG	I. P. Green	EGMN	E. G. M. Niblett
PRG	P. R. Green	ACT	A. C. Titchen
CSG	C. S. Greenway	MJT	M. J. Trotman
LH	Ms L. Houston		

The area covered by this report is essentially that defined by J. W. White for his *Flora of Bristol* (1912). The eastern boundary is taken as the old boundary of Wiltshire where it meets the old boundaries of both Gloucestershire and Somerset. The southern limit is taken as approximately the course of the River Brue along some of its length. The area comprises the northern part of the Watsonian vice-county of North Somerset (v.c. 6) and the southern part of West Gloucestershire (v.c. 34). In the following records these parts are designated **S** and **G** respectively.

Plant names are in accordance with C. Stace *New Flora of the British Isles*, 1991.

Ranunculus penicillatus (Dumort.) Bab. Several flowering patches along the Cheddar Yeo, Cross, **S,** RSC.

Ceratophyllum submersum L. In good quantity but fruiting very sparingly, pool, east of railway, Edithmead, **S,** RSC.

Ceratocapnos claviculata (L.) Liden Clutton, **S,** D. French.

Viola odorata L. × *V. hirta* L. (*V.* × *scabra* F. Braun) Walton Moor, Walton-in-Gordano, **S,** CSG. A few flowers in the clumps white with purple flashes and scentless.

V. canina L. Several patches along heathy ride, Stock Hill, Priddy, and in rough grassland near road, Priddy, **S,** RSC.

V. tricolor L. ssp. *tricolor* On disused railway line, Lyde Green, Pucklechurch, **G,** and a few plants in rough field incorporated into churchyard, Upper Cam, **G,** MARK & CK.

Hypericum androsaemum L. One plant near footpath by River Frome, Bromley Heath, **G,** MJT.

H. montanum L. Above the Avon in Crabtree Slip Wood, Shirehampton, **G,** MARK, CK, LH & ACT.

Cerastium pumilum Curtis With *C. semidecandrum* L., in thin turf, Wain's Hill, Clevedon, **S,** Walton Moor, Walton-in-Gordano **S,** and Uphill, **S,** CSG.

Montia fontana L. ssp. *amporitana* Sennen Wet flush in meadow, coastal path, Clevedon, **S,** CSG.

Atriplex littoralis L. One patch with about half-a-dozen plants setting seed, on sands by car park, Sand Point, **S,** CSG. Nearby were *Teucrium chamaedrys* L. and *Geranium versicolor* L.

A. portulacoides L. A good patch on saltmarsh below Crabtree Slip Wood, Shirehampton, **G,** MARK, CK *et al.* This site is about 1 km further up the river than previously recorded.

Malva neglecta Wallr. One flowering plant, Stert Point, **S,** RSC.

Geranium rotundifolium L. Black Rock Quarry, Weston-in-Gordano, **S,** and Wain's Hill, Clevedon, **S,** CSG.

Erodium moschatum (L.) L'Hér. One plant, with *Cerastium pumilum* Curtis and *Helianthemum apenninum* (L.) Miller, on rocky area of Purn Hill, **S,** PRG. A few strong plants, with *E. cicutarium* (L.) L'Hér. and *Geranium pusillum* L., on stony banks by footbridge over the M5, Clevedon Court Woods, **S,** CSG. Nearby was *Kickxia elatine* (L.) Dumort. and a few *Anacamptis pyramidalis* (L.) Rich. perhaps imported with the soil.

Trifolium ornithopodioides L. A few plants in lawn turfs, Weston-super-Mare, **S,** RSC.

T. striatum L. On Carboniferous limestone at Church Hill, Clevedon, S; also at 'Cadbury Camp', between Yatton and Congresbury, **S,** CSG. On rock outcrop, with *Cerastium pumilum* Curtis and *C. diffusum* Pers., Burrington Combe, **S,** RSC.

T. scabrum L. Plentiful, Wain's Hill, Clevedon, **S,** and Weston Lodge, Weston-in-Gordano, **S,** CSG.

T. subterraneum L. In thin turf, with sparse *T. micranthum* Viv., Weston Lodge, Weston-in-Gordano, **S,** CSG.

Onobrychis viciifolia Scop. Flowering well on grassy verge, Hinton Hill, **G,** and near Tormarton, **G,** PJC.

Vicia sylvatica L. On fences, West Park Wood, Clapton-in Gordano, **S,** CSG. Also in the wood *Hyacinthoides non-scripta* (L.) Chouard ex Rothm. var. *bracteata* Druce with green bracts 7-10 cm long, resembling small leaves, CSG.

V. bithynica (L.) L. A strong population, additional to that reported in *Bristol Botany in 1994*, p. 42, on road cutting, Shirehampton, **G,** MARK & CK.

Lathyrus nissolia L. With *Genista tinctoria* L., railway bank near Charlton Common, Filton, **G,** PJMN. Also on clay banks near Cribbs Causeway, **G,** CSG.

Filipendula vulgaris Moench Several plants in stony grassland above quarry, The Perch, Shipham, **S,** RSC.

Potentilla × *mixta* Nolte ex Reichb. Plentiful in one area on disused railway, Paulton, **S,** IPG.

Rosa rubiginosa L. Three large old bushes, south of Severn Beach, **G,** PJMN. J.W. White *Flora of Bristol*, 1912, p. 293, records two small bushes, some distance apart, on the shingly Severn beach below New Passage. These sites are probably not the same as, but near to, the new site. One bush, Walton-in-Gordano, **S,** CSG, conf. Rev. A.L. Primavesi.

R. micrantha Borrer ex Smith A few shrubs, King's Wood, Axbridge, woodland bordering Cross Plain, **S,** PJMN. One good bush in rough grassland, The Perch, Shipham, **S,** RSC.

Crataegus laevigata (Poiret) DC. Roadside hedges, Kingswood, near Wotton-under-Edge, **G,** MARK.

Sorbus domestica L. Several trees, cliffs west of Bristol, by the River Avon, **G,** MARK, CK, LH & ACT. The True Service Tree has only recently been recognised as native to Britain and is of extremely restricted distribution. This most interesting record is the second for v.c. 34. A third site was subsequently found in v.c. 34 but outside the area considered in this report.

S. eminens E. Warb. One large tree fruiting well and several smaller ones, cliffs west of Bristol, by River Avon, **G,** MARK, CK, LH & ACT, det. T.C.G. Rich, conf. PJMN. This site has been known by PJMN since 1961. One shrub, probably bird-sown, East Wood, Portishead, **S,** PJMN.

Myriophyllum spicatum L. Cross, **S,** RSC.

Viscum album L. On eight lime trees bordering drive to church, Dyrham, **G,** PJC.

Bupleurum tenuissimum L. A few fruiting plants in *Elytrigia atherica - Festuca rubra* sward, saltmarsh, Sea Mills, **G,** CK, MARK & SHB. Recorded for the bank of the Avon below Cook's Folly in 1863 (J.W. White *Flora of Bristol*, 1912, p. 337); the present locality seems to be T.B. Flower's site 'between Sea Mills and the Powder House' (*Ibid.*, p. 337). Persisting on the sea bank, Wick St. Lawrence, **S,** and also persisting in good quantity on the bank of the Avon near Pill, **S,** RSC.

Petroselinum segetum (L.) Koch Abundant on landward side of sea bank, Wick St. Lawrence, **S,** RSC.

Oenanthe pimpinelloides L. One plant in rough grassland, market garden, Bromley Heath, **G,** MJT.

O. lachenalii C. Gmelin In marsh, east of Chewton Wood, Ston Easton, **S,** J. Poingdestre.

Euphorbia serrulata Thuill. Fruiting, in rough field, part of parish churchyard, Upper Cam, **G,** MARK & CK. Also along footpath nearby, apparently as a garden escape.

E. exigua L. With *Kickxia elatine* (L.) Dumort., stony fields, skirting Weston Big Wood, Weston-in-Gordano, **S,** CSG.

E. paralias L. A flowering plant, and another immature, on a shingle beach (see H.J. Riddelsdell *et al.*, *Flora of Gloucestershire*, 1948, p. xlviii) along the shore, Severn Beach, **G,** PJMN. This is a first record for v.c. 34, a successful arrival from much lower down the Severn Estuary.

Rumex pulcher L. Two fruiting plants in grassland, The Perch, Shipham, **S,** RSC. Also present were *Danthonia decumbens* (L.) DC., plentiful *Hypericum pulchrum* L., *Rubia peregrina* L. and one plant of *Blackstonia perfoliata* (L.) Hudson, RSC.

Populus nigra L. ssp. *betulifolia* (Pursh) W. Wettst. Six pollards and one maiden tree, in addition to the tree reported in *Bristol Botany in 1992*, p. 29, at Frome Bridge, Old Sodbury, **G,** D.E. Green. This poplar has long been known in the area (H.J. Riddelsdell *et al.*, *Flora of Gloucestershire*, 1948, p. 441, gives Old Sodbury, near Dodington, E. Milne-Redhead). Also one pollard, Lower Kingrove Farm, Sodbury, and eight pollards, Kingrove Common, Sodbury, **G,** D.E. Green.

Echium vulgare L. With *Brachypodium pinnatum* (L.) P. Beauv., *Cynoglossum officinale* L. and *Geranium pusillum* L., stony pasture, Tickenham Hill Fort, **S,** CSG.

Verbascum nigrum L. One plant at edge of car park, Sidcot, **S,** DM.

Veronica agrestis L. One plant, below Tickenham Hill Fort, **S,** CSG. This formerly common weed of cultivated and waste ground appears to be now scarce in parts of N. Somerset.

Orobanche hederae Duby On stream bank, by track, Cheddar, **S,** PRG. Also in car park, Wookey Hole, **S,** DM.

Clinopodium ascendens (Jordan) Samp. One plant near old quarry, also *Erigeron acer* L., Felton Common, **S,** RSC.

Lamium amplexicaule L. The Sidelands, Wraxall, S; reservoir, Cheddar, S; and Uphill, **S,** CSG.

Galeopsis bifida Boenn. Bromley Heath, **G,** MJT.

Galium × *pomeranicum* Retz. In grassland, in Nature Reserve, Charterhouse, Mendip, **S,** and Cross Plain, near Axbridge, **S,** PJMN.

Lonicera xylosteum L. One small bush, near road, Lascot Hill, Wedmore, **S,** IPG. Single bush on edge of scrub, Church Hill, West End, Nailsea, **S,** PRG.

Valerianella carinata Lois. Two plants, banks of lay-by, Black Rock Quarry, Weston-in Gordano, **S,** CSG.

Senecio vulgaris L. var. *denticulatus* (Mueller) N. Hylander Two plants of the ligulate woolly variety, Uphill, **S,** CSG.

Anthemis arvensis L. Abundant alongside new road, Shortwood, **G,** MARK & CK.

Carduus × *dubius* Balbis (*C. crispus* L. × *C. nutans* L.) On plateau, Durdham Down, Bristol, **G,** the late Miss I.F. Gravestock, det. A. J. Willis.

Cirsium × *forsteri* (Smith) Loudon (*C. dissectum* (L.) Hill × *C. palustre* (L.) Scop.) One plant, with both parents, Max Bog, Winscombe, **S,** RSC.

Centaurea cyanus L. Abundant on verge of new road, Shortwood, **G,** MARK & CK.

Lactuca virosa L. A few plants, with more frequent *L. serriola* L., lane by Golf Course, Cadbury Camp, Tickenham, **S,** CSG.

Butomus umbellatus L. One clump, bank of River Avon, Saltford, **S,** EGMN.

Groenlandia densa (L.) Fourr. Scarce, in rhines, Walton-in-Gordano, **S,** CSG; this pondweed is probably decreasing in N. Somerset. Persisting in this vicinity, but not in great quantity, are *Eleogiton fluitans* (L.) Link, *Isolepis cernua* (Vahl) Roemer & Schultes and *I. setacea* (L.) R. Br.; also here, on banks of the rhines, *Hydrocotyle vulgaris* L., *Hypericum humifusum* L. and *Stellaria uliginosa* Murray, CSG.

Ornithogalum angustifolium Boreau A few flowering plants, West Littleton, **G,** PJC. Several patches on road verge, Edingworth, **S,** PRG.

O. pyrenaicum L. One plant in field, Chestnut Farm, Wedmore, **S,** Mrs A. Badley.

Paris quadrifolia L. Wood between Valley Road and Middle Ground, above Weston-in-Gordano, **S,** EGMN.

Allium oleraceum L. In good quantity, alongside road cutting, Shirehampton Park, Shirehampton, **G,** MARK & CK.

Neottia nidus-avis (L.) Rich. Beneath hazel, Burrington Ham, **S,** RSC.

Platanthera chlorantha (Custer) Reichb. Weston Big Wood, Weston-in-Gordano, **S,** CSG, where also *Primula vulgaris* Hudson, forma *caulescens* (Koch) Schinz & Thell., with flowers in an umbel on a scape, CSG. A few Greater Butterfly Orchids at the margin of Cheddar Wood, **S,** RSC.

Ophrys apifera Hudson Only three inflorescences seen, Cold Harbour, **G,** PJC.

O. insectifera L. A single flowering plant, Clifton side of the Avon Gorge, Bristol, **G,** PJMN. This is a welcome return to the City side of the Gorge, from which this orchid has not been reported since the time of E.H. Swete's *Flora Bristoliensis* (1854, p. 76).

O. insectifera L. × *O. apifera* Hudson (*O.* × *pietzschii* Kümpel nom. inval.) First reported under the name *O. muscifera* Huds. (*O. insectifera* L.) from Leigh Woods, Bristol, S (*Bristol Botany in 1968*, p. 489, Plates XI and XII), this orchid was later found to be a hybrid of the Fly and Bee orchids (*Bristol Botany in 1976*, pp. 24-25). Photographs of the plant *in situ* were shown by R.J. Pankhurst at the Annual Exhibition Meeting of the Botanical Society of the British Isles in November 1976 (see *Watsonia*, 1977, Vol. 11, Pt. 4, p. 430). A full account of this hybrid (the Leigh Woods plant being its first recorded natural population in the world) is given in the article entitled *Ophrys apifera* Huds. × *O. insectifera* L., a natural hybrid in Britain, by A.J. Willis (*Watsonia*, 1980, Vol. 13, Pt. 2, pp. 97-102). In 1968 four specimens were seen, and for the next decade an average of some 5

or 6 annually; more recently numbers have fallen and this plant is now believed extinct. It is feared that one or more plants may have been dug up, the last sighting being in 1992 or 1993.

Orchis morio L. One plant, scrubby grassland, adjoining Cheddar Wood, **S,** RSC.

Anacamptis pyramidalis (L.) Rich. Seven plants, derelict chemical site, south of Severn Beach, **G,** PJMN. This orchid is known elsewhere on chemical waste, e.g. Merseyside, but less plentifully than *Gymnadenia conopsea*. Flowering well, Battlefields, **G,** and on road embankment, Dodington Ash, **G,** PJC. Two plants, Crook Peak, **S,** RSC.

Typha angustifolia L. A patch with about 20 inflorescences, rhine, Wick St. Lawrence, **S,** RSC.

Carex distans L. On sea-wall, Kingston Seymour, **S,** RSC.

C. extensa Gooden. With *Asparagus officinalis* L., in grassland, the Estuary, Clevedon, **S,** CSG.

C. pallescens L. Fruiting, with fruiting *C. pilulifera* L., in damp meadow, Holcombe, **S,** RSC. Also *Dactylorhiza praetermissa* (Druce) Soó and *D. maculata* (L.) Soó.

C. muricata L. A few plants in Nature Reserve, Charterhouse, **S,** PRG.

C. pulicaris L. Fruiting in good quantity, with *Danthonia decumbens* (L.) DC., on rough grassy slope, Burrington Combe, **S,** RSC. Also patches of *Aira praecox* L. on rock outcrop here, RSC.

Lolium perenne L. var. *cristatum* Pers. Several plants of this cristate form in old pasture, Kingswood, near Wotton-under-Edge, **G,** MJT, det. R.M. Payne.

Puccinellia rupestris (With.) Fern. & Weath. In crevices of flagstones, where known also in 1986, on waterfront, Pill, **S,** RSC. This grass was reported to be seen 'very sparingly at Pill' in the article *J.L. Knapp's 'Gramina Britannica' - its local interest* by P.J.M. Nethercott (these *Proceedings* for 1976, Vol. 36, p. 116).

Leymus arenarius (L.) Hochst. A small flowering patch, Stert Island, **S,** RSC. Recorded here in 1975.

ALIENS

Nigella damascena L. Well established on grassy bank in road cutting, Shirehampton Park, Shirehampton, **G,** MARK & CK.

Eschscholzia californica Cham. A good patch in rough grassland recently incorporated into parish churchyard, Upper Cam, **G,** MARK & CK.

Viola odorata L. var. *subcarnea* (Jord.) Parl. One patch, growing completely wild, in shady bank of ditch, Weston Lodge, Weston-in-Gordano, **G,** CSG.

Amaranthus retroflexus L. Plentiful, market garden, Bromley Heath, **G,** MJT. Single plant on road verge, Westhay, **S,** PRG.

Chenopodium hybridum L. Three plants on verge of new road, Wells, **S,** IPG. The last record of this plant in N. Somerset is as long ago as 1896, from Corston, near Bath (J.W. White, *Flora of Bristol*, 1912, p. 507).

Staphylea pinnata L. Two large shrubs by path adjoining Mells stream, Great Elm, **S,** CJC.

Rhus hirta (L.) Sudw. On road bank amongst elm trees, Compton Bishop, **S,** DM.

Galega officinalis L. With white flowers, well established in grassy area, Hengrove Park, Bristol, **G,** PJMN.

Rubus cockburnianus Hemsley One patch, near Mells stream, Great Elm, **S,** PRG.

Sanguisorba minor Scop. ssp. *muricata* (Gremli) Briq. Plentiful, with *Rapistrum rugosum* (L.) Bergeret and *Salvia verbenaca* L., on bypass around Glastonbury, **S,** IPG.

Rosa glauca Pourret non Villars ex Lois. (*R. rubrifolia* Villars nom. illegit.) One fine shrub, presumably bird-sown, Hengrove Park (the old Whitchurch airport), Bristol, **S,** PJMN. This garden rose has not been previously recorded in the Bristol area.

Cotoneaster divaricatus Rehder & E. Wilson Several bushes on old wall, Great Elm, **S,** IPG, det. Mrs J. Fryer.

Sorbus intermedia (Ehrh.) Pers. One shrub, probably bird-sown, abandoned part of Sea Mills station, **G,** PJMN. A small tree in scrub on grassy bank of road cutting and one small seedling nearby, Shirehampton Park, Shirehampton, **G,** MARK, CK & SHB, conf. PJMN.

S. pinnatifida Ehrh. The cultivated tree in front of Buckingham Chapel, Queen's Road, Clifton, Bristol, G, mentioned under this name in The Botanical Society and Exchange Club of the British Isles Report for 1937, Vol. XI, Pt. VI, submitted by H.S. Thompson to A.J. Wilmott (BM[NH]) is now dead, only part of the trunk remaining. Wilmott considered it 'as one of several forms to which the name is often applied, but both the botany and the nomenclature of them need further investigation'. It remains uncertainly named, appearing to be a cultivated form probably arising by hybridity between *S. aria* and *S. aucuparia* or as a closely related taxon of one of these, PJMN.

Sedum dasyphyllum L. Well established on stone walls, near Naish House, Clapton-in-Gordano. **S,** CSG.

Deutzia scabra Thunb. One large bush by path, Great Elm, **S,** Miss G.A. Crouch, conf. EJC.

Aralia elata (Miq.) Seemann By path at edge of trees, Great Elm, **S,** CJC, conf. EJC.

Cucumis melo L. Several plants, Sewage Works, Avonmouth, **G,** JPM. Plentiful, with fruits forming on several plants, verge of new road, Wells, **S,** IPG.

Fallopia japonica (Houtt.) Ronse Decraene × *F. sachalinensis* (F. Schmidt ex Maxim.) Ronse Decraene (*F.* × *bohemica* (Chrtek & Chrtková) J. Bailey) Adjoining car park, Armstrong Hall, Thornbury, **G,** JPM. Previous records for v.c. 34 are for Shirehampton - Avonmouth (*Bristol Botany in 1986*, p. 69) and Observatory Hill, Clifton (*Bristol Botany in 1988*, p. xxx). This hybrid is also known in v.c. 6 at Rownham and Belmont Hill (*Bristol Botany in 1987*, p. xxx).

Symphytum 'Hidcote Blue' (*S. grandiflorum* DC. × ? *S.* × *uplandicum* Nyman) One patch near hedge by footpath, Wedmore, **S,** IPG.

S. orientale L. Several clumps on road verge, West End, Nailsea, **S,** IPG & PRG.

Pulmonaria officinalis L. A large patch under trees in hedge adjoining road, Charterhouse, **S,** DM.

Calystegia pulchra Brummitt & Heyw. On hedge by road, Burnham-on-Sea, **S,** PRG.

Nicandra physalodes (L.) Gaertner One plant with ripe fruit, and several plants of *Helianthus annuus* L., Sewage Works, Avonmouth, **G,** JPM.

Physalis philadelphica Lam. Two flowering plants of this rare casual, Sewage Works, Avonmouth, **G,** JPM. Also *P. peruviana* L. known here by JPM for several years.

Datura stramonium L. Plentiful in flower and fruit; also one flowering plant of *D. stramonium* var. *tatula* (L.) Torrey, Sewage Works, Avonmouth, **G,** JPM.

Verbascum blattaria L. One plant, setting abundant seed, with plentiful *Senecio viscosus* L., Black Rock Quarry, Weston-in-Gordano, **S,** CSG. Single plant, road verge, Westhay, **S,** IPG.

Mimulus moschatus Douglas ex Lindley Plentiful under wall, near church, Wedmore, **S,** IPG.

Campanula portenschlagiana Schultes Walls near parish church, Chipping Sodbury, **G,** MARK & CK.

Bidens aurea (Aiton) Sherff Several plants in pavement cracks, Church Street, Wedmore, **S,** IPG.

Galinsoga quadriradiata Ruíz Lopez & Pavón Market garden, Bromley Heath, **G,** MJT.

Senecio × *albescens* Burb. & Colgan One plant, with *Petroselinum crispum* (Miller) Nyman ex A.W. Hill, in disused quarry, Purn, **S,** PRG.

Chrysanthemum segetum L. One plant on sand heap at edge of car park, Wedmore, **S,** IPG.

Lilium martagon L. One flowering plant in cleared woodland, previously almost impenetrable, Old Down Estates, Old Down, near Tockington, **G,** Mrs S.M. Wilton. The plant was not seen in the Old Down House garden and must have long persisted in this woodland, as it has in Leigh Woods, Bristol (*Bristol Botany in 1992*, p. 34).

Muscari armeniacum Leichtlin ex Baker With *M. neglectum* Guss. ex Ten., roadside verge, Kingswood, near Wotton-under-Edge, **G,** MJT. A single clump on disused quarry face, Purn, **S,** PRG.

Allium carinatum L. Abundant on road verge, Mells, **S,** IPG.

A. roseum L. A small colony in the 'Fairyland' area of Clifton Down, Bristol, **G,** PJMN. Recorded from St. Vincent's Rocks since 1904.

Hermodactylus tuberosus (L.) Miller In road hedge by gateway to dunes, Berrow, **S,** A. Vowles. This is a different site from the one reported in *Bristol Botany in 1993*, p. 46.

Crocus vernus (L.) Hill A few plants on road verge, Edingworth, **S,** DM, conf. IPG. Also a few plants here of *C. flavus* Weston × *C. angustifolius* Weston, DM, conf. IPG.

Crocosmia paniculata (Klatt) Goldblatt Two clumps in rough grass near pond on dunes, Berrow, **S,** W.G. Last, conf. PRG.

Arum italicum Miller ssp. *italicum* Abundant in rough area with trees, Mells, **S,** DM. Several clumps, bank of Kennet and Avon canal, Monkton Combe, **S,** PRG.

Lemna minuta Kunth Pond, Avon Wildlife Trust's wildlife centre, Willsbridge, **G,** Dr J.S. Rees. This is a first record for v.c. 34; it is not known how this tiny duckweed has been introduced here.

Anisantha madritensis (L.) Nevski Several populations, cliffs by River Avon, Crabtree Slip Wood, Shirehampton, **G,** MARK, CK, LH & ACT. In good quantity in several places by road cutting, Shirehampton Park, **G,** MARK & CK. Plentiful on banks of bridge, Edithmead, **S,** IPG.

Panicum miliaceum L. In road gutter, Wotton-under-Edge, **G,** MJT. Known here by MARK for several years.

MUSCI

Zygodon baumgartneri Malta In 1995, on tree trunk near stream, Ozleworth Bottom, east of Wotton-under-Edge, **G,** P. Martin & G. Brown.

Thuidium abietinum (Hedw.) Br. Eur. ssp. *hystricosum* (Mitt.) Kindb. In 1995, in unimproved limestone grassland, Westbury-sub-Mendip, **S,** T. Smith.

FUNGI

Morchella esculenta St. Amans Two morels in late April by old hedge adjoining path, Bishop Sutton, **S,** D. Warden. This infrequent edible fungus has not previously been reported here.

ACKNOWLEDGEMENTS

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THE DEFINITION OF THE SEVERN ESTUARY

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ABSTRACT

The mouth or the outer limit of an estuary can be defined in terms of several criteria. The most usual is by reference to the dilution of salinity by the freshwater discharged by the river. Furthermore the form of the coast, the presence of banks and shoals, the patterns of sediment movement, and the changing tides within the estuary define the outer limit. Normally these factors are interconnected.

In the Severn Estuary the distribution of salinity shows wide variation depending on the tidal range and river discharge. The limit of the area where the sea water is affected by dilution by fresh water, when defined by a salinity less than 95% of that of sea water for 95% of the time, lies between Barry and Minehead. The outer limit of the estuary is, therefore, seaward of the narrows located at the position of the Holm Islands.

Consideration of the form of the coast, and the underwater banks and channels of the Severn, suggests that the line of the Holm Islands presents features that would normally be associated with an estuary mouth. Inwards of this line, the tidal range, the shape of the tidal curve and the relative strengths of the flood and ebb currents also show rapid change due to the increasing shallowing and narrowing of the estuary.

The residence time for fresh water within the estuary eastwards of the Holm Islands is 60-150 days, and within this area there are elevated concentrations of nutrients, such as nitrates and phosphates, which are derived from run-off from the land and from effluent inputs. However, algal blooms are suppressed because the very high concentrations of suspended sediment reduce light penetration and limit the amount of photosynthesis. Nevertheless, blooms occur further west where the concentrations are lower, but where nutrients are still present. Algal blooms are potentially possible in shallower water within the estuary at times when the water is clearer.

It is concluded that the outer limit of the Severn Estuary is defined seaward of the Holm Islands, on the grounds of salinity distribution, and of characteristics dependent on the topography.

INTRODUCTION

There are over 40 different definitions of estuaries, but they all depend to some extent on either defining the limit of the area affected by the dilution of sea water with fresh water discharged by a river, or on features related to the topography.

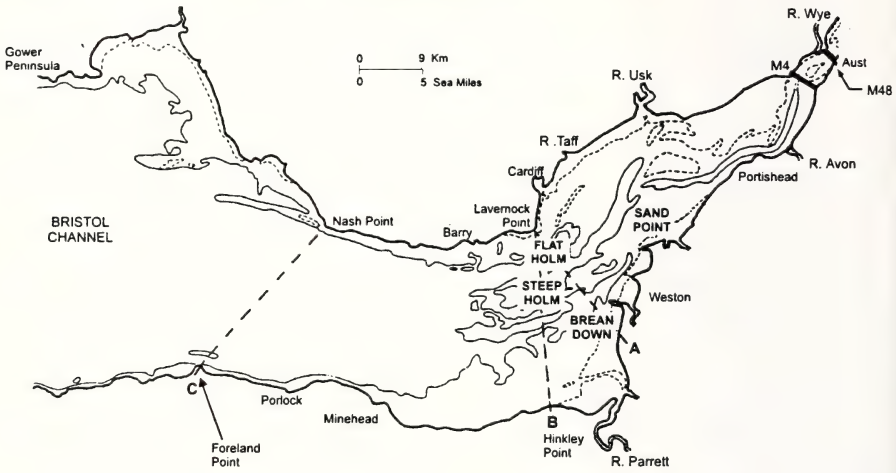

FIGURE 1. Location plan of the Severn Estuary and Bristol Channel
Dashed contour: low water mark; thin full contour: 5m depth

A satisfactory general definition that has recently been stated is: 'An estuary is a semi-enclosed coastal body of water which has free connection to the open sea, extending into the river as far as the limit of tidal influence, and within which sea water is measurably diluted with fresh water derived from land drainage.' Consequently, the application of this definition to particular examples requires specification of the distribution of salinity, and of the degree of dilution.

The topography of estuaries depends on the rise in sea level between about 18,000 and 5,000 years before present, from a depth of about 100m, which drowned the lower valleys of rivers. Coastal erosion during the rise released sediment. This is transported along the beaches by waves to the estuary mouth and there it is sorted by the tidal currents. The sand and gravel fractions form spits and headlands which narrow the mouth, restrict the free flow of sea water, and create sand banks and shoals in a zone close to the mouth. The fine sediment fraction is carried in suspension towards the head of the estuary where it is trapped, forms mudflats and where the suspended particles make the water turbid, thereby reducing light penetration.

The narrowing and shallowing in the estuary upstream of the mouth can amplify the tidal range at the head of the estuary and distorts the tidal flows, making the flood currents progressively stronger than the ebb currents. This flood tide enhancement helps the residual currents to trap the fine sediment at the head of the estuary near the limit of salinity intrusion, where it forms water more turbid than that in the coastal waters, or in the river; a feature known as a turbidity maximum. Most sediment trapped in this way comes from the sea rather than from the river. Consequently, the mouth of the estuary is marked by a change in the tidal characteristics, and in the sediment distribution.

The reduction in light penetration due to the turbidity limits the amount of photosynthesis that can occur, and the growth of algae. Photosynthesis requires light-energy, nutrients and carbon dioxide. Excess of nutrients would produce algal blooms, were it not for the limited light. In the clearer coastal waters availability of nutrients, rather than light, is the limitation on photosynthesis and on blooms. When the magnitude of the algal blooms is great enough to limit oxygen transfer from the atmosphere, a dramatic reduction in dissolved oxygen occurs, producing an effect known as eutrophication. To avoid this, effluent discharges into estuaries have to be controlled.

For the purposes of the Urban Waste Water Regulations 1994, the United Kingdom has adopted two alternative definitions of estuaries. These are:

> an area receiving freshwater inputs where the waters on a depth-averaged basis have a salinity of less than 95% of the adjacent local offshore seawater for 95% of the time.
>
> an inlet of the sea bounded by a line between such topographical features as define the seaward boundary of the estuary.

Application of these criteria to the outer limits of the Severn Estuary has been controversial, and led to a Judicial Review. This paper considers the scientific evidence for definition of the outer limits of the Severn Estuary. There is general agreement that the inner limit of the estuary is at Maisemore Weir.

EXISTING DEFINITIONS OF THE SEVERN ESTUARY

The term estuary has only been in serious use over the last two centuries, and ancient maps refer to the area between Aust and Cardiff as Sabrina Fluvius (Severn River). The outer limit of the Severn Estuary has been variously defined on topographic terms, but all definitions include the water body east of the line of the Holm Islands; Flat Holm and Steep Holm (Figure 1). After re-organization of the water industry in 1974, the Severn-Trent, Wessex, South West and Welsh Water Authorities defined the limits of the Severn Estuary as extending from Maisemore Weir on the River Severn to a line joining a point just east of Worm's Head (Gower, Wales) to Hartland Point (N. Devon). This outer line is to the west of the area shown in Figure 1.

The Admiralty Hydrographic Office in the Bristol Channel Pilot define the Severn River as ending at a line between Sudbrook Point and Cross Hands (close to the new M4 Road Bridge). The Severn Estuary is from that line to a line between Lavernock Point and Sand Point, and the Bristol Channel extends from there to a line between Hartland Point and St. Govan's Head (to the west of the area shown in Figure 1).

All of the studies carried out for the Severn Barrage Study used the definition of a line between Lavernock Point and a point just south of Brean Down (Figure 1, Line A) as the outer limit. The Lavernock Point-Brean Down line was also defined in a scientific review by the Natural Environment Research Council (NERC, 1972).

The Water Resources Act (1991) defined the limit of the estuary as from Lavernock Point to Hinkley Point, and this has been used by the National River Authority (Figure 1, Line B). However, at one time the consensus opinion of the Severn Estuary Strategy Project Team, formed to progress a Catchment Management for the Severn Estuary, was for the lower limit to be the line between Nash Point, South Glamorgan, and Foreland Point near Lynton (Figure 1, Line C).

Consequently, there are a number of conflicting definitions of the outer limit of the Severn Estuary, though there is general agreement that the inner limit is at Maisemore Weir, where the penetration of the tide normally stops.

DEFINITION BASED ON SALINITY DISTRIBUTION

Definition of the estuary in terms of salinity, based on the outer limit of the estuary having a salinity of 95% of the adjacent seawater for 95% of the time, requires specification of the salinity of the undiluted seawater and measurement of the variation with time of the salinity levels within the area. An increase in river discharge causes the saline water to be forced downstream, and a decrease allows it to creep landwards. There are also significant variations between neap and spring tides, and due to wind and barometric pressure. These aspects will be considered using published data.

an outer estuary where the salinity rises more gradually towards that of sea water. The general form of the depth-averaged salinity distribution along an estuary has three segments:

- an inner estuary which is dominated by riverine processes where the salinity increases slowly downstream;
- a middle estuary where there is active mixing and the salinity rises rapidly;
- an outer estuary where the salinity rises more gradually towards that of sea water

The 95% limit would be reached within the outer estuary. Since the whole salinity structure moves within the estuary, depending on changes in river flow, tidal range, and the rate of change of cross sectional area, the limits alter drastically with time. Because of the strong tidal currents, the Severn Estuary and Bristol Channel are well mixed vertically, and the surface salinity is a good measure of the depth-mean salinity, though there are significant differences across the channel.

Open sea water in the Atlantic has a salinity generally about 35.5 ppt (parts per thousand). Extensive measurements within the Bristol Channel (Figure 2) have shown that there is a considerable reduction in the salinity throughout the whole region, though 35 ppt is present sometimes near Lundy Island. The salinities on the N. Devon coast are 1-2 ppt higher than those on the Welsh coast due to the lower discharge of water from the former, and there is a zone of high gradient of salinity in the area between the Holm Islands and Minehead. The outer limit of the high gradient zone has a salinity of about 32 - 33 ppt, and this can be considered to be the inner limit of coastal water and the outer limit of the dilution caused by the rivers entering the Severn Estuary

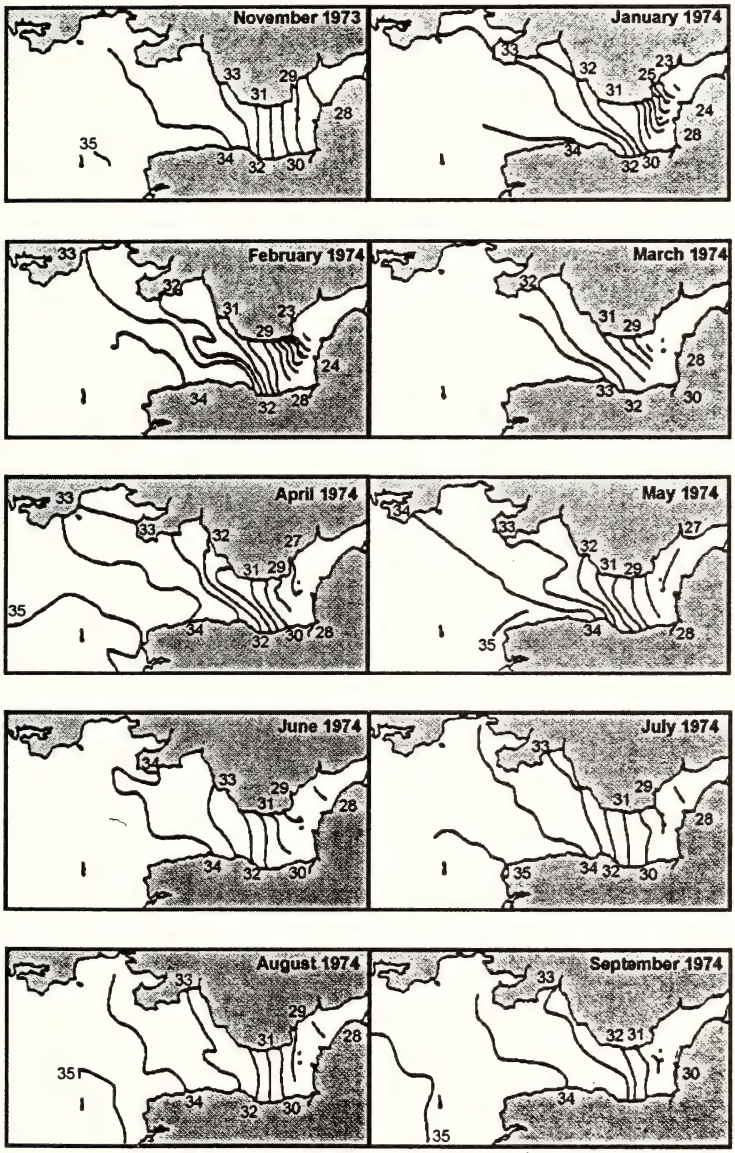

FIGURE 2 Salinity contours at high water in parts per thousand (ppt) for the period November 1973 to September 1974. After Uncles (1984).

Observations of the longitudinal salinity distribution within the estuary shows that waters as far as Minehead are affected by changes of salinity caused by variation of river discharge. The results of Bassindale (1943) shown in Figure 3 indicate that sea water unaffected by the discharge of the Severn and its tributaries has a salinity of at least 32 ppt. From this data the position where salinity is 95% of sea salinity is found seaward of Hinkley Point. Very similar data have been shown by more recent studies, such as Uncles & Radford (1980) and the Severn Barrage Report (1989).

Bassindale (1943) showed that the high-water salinity in Cardiff Roads and at Weston varies annually between about 22-28 ppt. The average salinity at Aust during low-flow summer conditions is about 25 ppt (78% of the sea water value) and this varies little between neap and spring tides. During the winter high river-flow, the maximum salinity at Aust is about 15 ppt (47%), but with very large variation, reaching virtually fresh water at times.

Using salinity as the definition of the estuary emphasises that the reduced salinity in the Severn Estuary is the combined result of the outflows of the rivers Severn, Wye, Usk, Avon, Taff and Parrett, together with numerous small rivers and streams. The mouths of those sub-estuaries are located within the larger system, and it is inevitable that their waters will interact and influence each other. Within the area of reduced salinity and large salinity variation there are changes in the flora and fauna (Bassindale 1943, Little & Smith 1980, Smith & Little 1980).

Thus the location where the salinity is greater than 95% of sea water for 95% of the time is difficult to define precisely because of the fluctuating nature of the river discharge, but it is likely to be at the western end of the zone of high salinity gradient shown on Figure 3, i.e. between Barry and Minehead.

DEFINITION IN TERMS OF TOPOGRAPHY

Two topographical features are used as the definition of an estuary mouth. They are:

- the coastline form, and
- the underwater topography, or morphology, together with the associated sediment distribution.

In terms of coastline form, a mouth width of about 10km separates estuaries into narrow and wide categories (Harris 1988). The former will often have one, or a pair of sand or gravel spits which narrow or constrict the estuary entrance. The spits are formed by sediment arising from coast erosion being transported by waves along the beach towards the estuary. The spits build out until there is a balance between the rate at which sand is transported to the tip of the spit by waves, and the rate at which it is swept away by the tidal currents flowing in and out of the estuary. The narrowing causes locally stronger current velocities and restricts free exchange with the coastal waters. The underwater morphology of a narrow estuary consists of a pattern of sand banks, and shoals, and a distribution of sediment that results from the deposition of the sediment carried into the estuary on the flood tide, and out of the estuary on the ebb tide. The sediment accumulates to form banks and shoals, inside and outside the mouth around which sand tends to circulate, and which are known as 'flood and ebb' deltas, respectively. Additionally, the stronger currents at the mouth produce erosion and local holes or pits that are deeper than areas away from the mouth

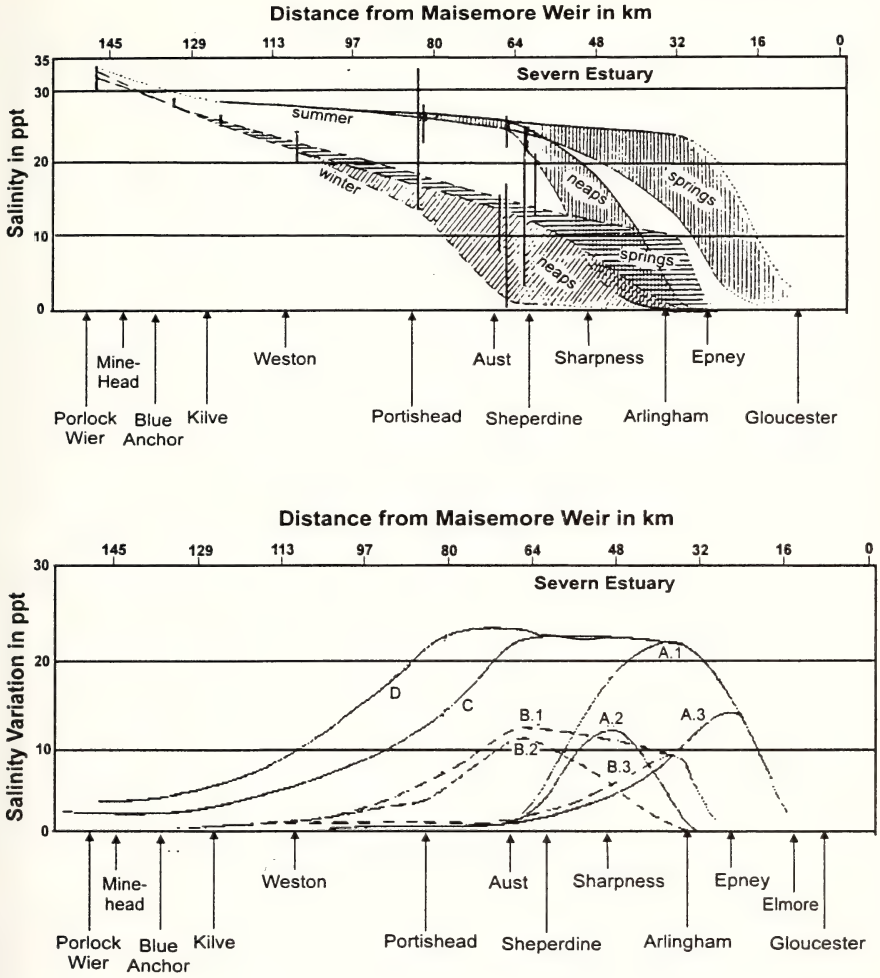

FIGURE 3 *Upper:* Longitudinal salinity distributions in 1940 for various conditions. The thick vertical lines show additional measurements. *Lower*: The salinity variations. A, summer, A1 whole month, A2 neap tides, A3 spring tides. B, winter, B1 whole month, B2 neap tides, B3 spring tides. C, during the whole of 1939-40. D, including all records. After Bassindale (1943)

For a wide estuary, the outer part, dominated by tidal energy, has strong tidal currents, while the inner part is dominated by river currents. In this situation the mouth of the estuary is defined as the outer limit of a series of tidal sand banks aligned with the tidal flow direction (Dalrymple *et al.*, 1992).

Together the coastline shape and the underwater morphology affect the tidal characteristics of an estuary. A narrowing and shallowing of the estuary increases friction, slowing down the tidal wave, but tending to increase its height. The duration of the flood tide becomes relatively shorter and the currents faster than the ebb tide. These changes occur significantly at the mouth.

The three above factors - the coastline shape, the underwater topography and the tidal changes - generally define the same location for the estuary mouth. They will be considered in turn.

Coastline form of the Severn Estuary

The Severn Estuary has been created by the drowning of the valley of the Severn River and its tributaries by the sea level rise. Because of the hard rock strata there has not been extensive coast erosion nor the release of sediment for the formation of spits, despite the exposure to storm waves from the west. However, there is a constriction at the line between Lavernock Point and Brean Down caused by a limestone outcrop, which encompasses the islands of Flat Holm and Steep Holm. There is a local maximum in current strength on that line, and it is the location where many tidal characteristics start to change rapidly in response to the changing hydrodynamics of the system (Uncles, 1981). This constriction acts similarly to the mouth of the estuary.

Since the width is about 10km, features of both narrow and wide estuaries may occur.

Underwater morphology of the Severn

The direction of sediment movement of sand and gravel depends on the direction of the average of the frictional force on the bed taken over the tidal cycle. Where there is sediment moving in opposite directions away from a zone of erosion, such as an estuary mouth, a feature known as a 'bed load parting' is formed. In narrow estuaries it forms an essential feature of the ebb and flood delta sand bank system associated with the estuary mouth. A 'bed load parting' had been predicted from sonar studies of the sea bed in the Bristol Channel/Severn Estuary (Stride, 1963), and mathematical modelling has shown that its location is likely to be between Minehead and the Holm Islands (Uncles, 1981).

On the Lavernock Point-Brean Down line there is an over-deepened area, with extensive bare rock, and sand banks to the west and the east form components of what can be considered as a flood and ebb delta system (Figure 4). However, the system is complicated by the presence of the Holm Islands which divide the channel into three. Culver Sand and Holm Sand could be considered as part of the ebb delta, and Cardiff Grounds part of the flood delta. There is circulation of the sand around the banks in a pattern that would be expected for flood and ebb deltas. The circulation is shown by the postulated overall sand transport patterns in Figure 4.

In terms of a wide estuary the tidal sand banks would be Culver Sand and Holm Sand, and the mouth of the estuary would be at their outer, westward, limit.

Thus the topographic form and underwater morphology of the Severn Estuary suggest that the mouth should be defined either at the line of the Holm Islands, or to the west at the limit of the sand banks.

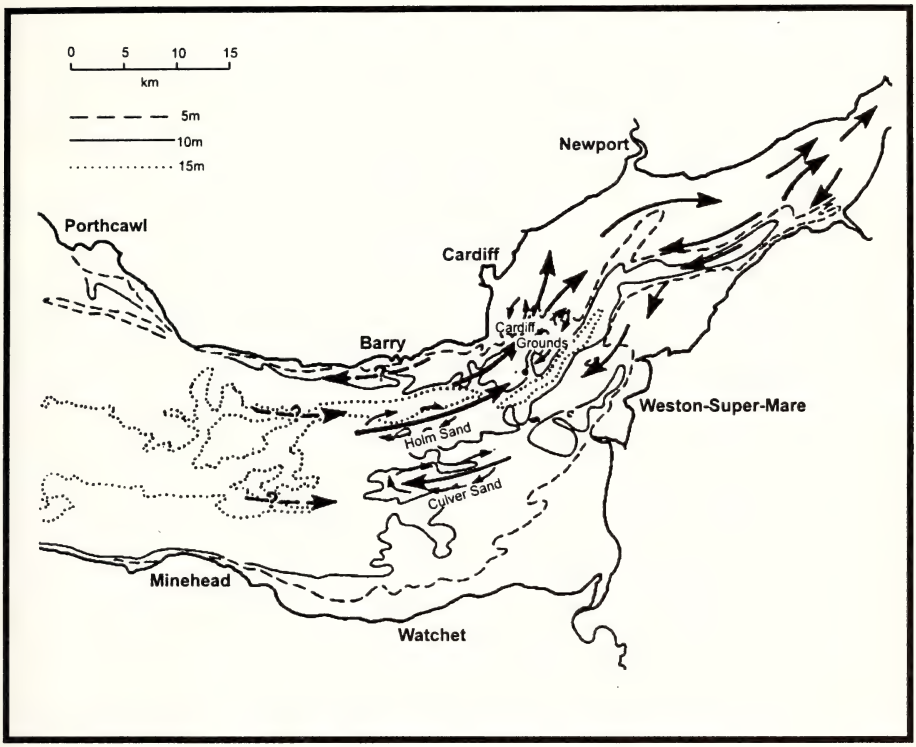

FIGURE 4. Schematized sand transport paths. Arrows denote direction of residual movement. From Parker & Kirby (1972).

Tides in the Severn Estuary

The Bristol Channel/Severn Estuary is funnel shaped, and this has the effect of amplifying the tide so that it is one of the highest in the world. The narrowing compresses the tidal wave into a smaller width as it progresses into the estuary so that its range increases. However, the shallower water creates friction which tends to decrease the tidal range, and causes asymmetry in the tide resulting in flood currents being stronger in magnitude, but shorter in duration, than the ebb currents. The balance between these two effects changes along the estuary. The importance of friction is apparent in the amplitudes and phases of the shorter period harmonics of the tidal elevations and currents, as these reflect the asymmetry. Uncles (1981) has analysed the distribution of these tidal constituents, and shows that major changes occur in the vicinity of the Holm Islands.. Further rapid changes occur landward of Aust where increased friction exceeds the effect of narrowing, and the tidal range decreases rapidly. The charted water depths show that at Aust at spring tide the low-water level intersects the estuary bed as it shallows landwards, so that all of the water filling the estuary landwards of that point at high water is flushed out at low water, apart from a residual drainage from the river, streams and marshes. This situation is

normally considered to occur at the seaward limit of the riverine, or inner, section of an estuary.

Thus the rapid change in the tidal response of the Severn landward of the Holm Islands supports the conclusion that the limit of the estuary should also be defined as occurring at that location.

DISCUSSION

As tides rise and fall the water mass moves up and down the estuary, but the fresh water slowly moves towards the sea, mixing with the sea water as it goes. A measure of the mixing or dispersion in an estuarine water mass is the time taken for a tidal increment of the river discharge to escape to the sea. This is known as the residence, or flushing time. It can be calculated from the salinity distribution and, for the Severn Estuary as defined by the salinity criterion, it is 60-150 days, depending on river discharge. The residence time for water at Aust varies from 8-20 days. Consequently, the water does not pass through the estuary very rapidly, only moving about 1 km per day, despite the fact that the tidal oscillation of the water is 12 to 25 km. This net velocity is similar to that in other estuaries, but is much less than that expected in coastal waters.

There are several other features of estuaries that occur as a consequence of the reduced salinity and of the tidal effects, and that are also characteristic of estuaries.

WATER MOVEMENTS

Averaging out the water movements due to the tide reveals that there is a general residual inflow of water along the N. Devon coast which switches over to continue along the Welsh coast past Barry and Cardiff (Parker & Kirby, 1982). There, salinity is higher than on the English side, the reverse of that present further seawards. There is also evidence supported by remote sensing, that in the shallower water on the English side there is trapping of water in eddies within Sand Bay, Weston Bay and Bridgwater Bay. The eastern side of the estuary consequently has an ebb directed residual, and the Welsh side a flood directed residual. Between these two zones there is a line, a 'front', which extends from the region of Hinkley Point and up the centre of the estuary where the residual currents change direction. This has implications for effluent dispersal.

ALGAL BLOOMS

Large quantities of nutrients from run-off and effluents are available for algal growth if there is sufficient light available to cause photosynthesis (Owen 1984). Under normal circumstances the algae produced by this primary productivity (also known as phytoplankton; 'the grass of the sea') would be grazed by zooplankton. Too much nutrient provides the potential for massive growth of algae where sufficient light is available, causing blooms. In the Severn Estuary, its highly turbid nature restricts growth, as shown by relatively low concentrations of chlorophyll-a, which is the accepted measure of the abundance of planktonic algae. However in some years, towards the west where the turbidity decreases, the primary productivity increases and there are occasional blooms of *Phaeocystis* (Joint, 1984).

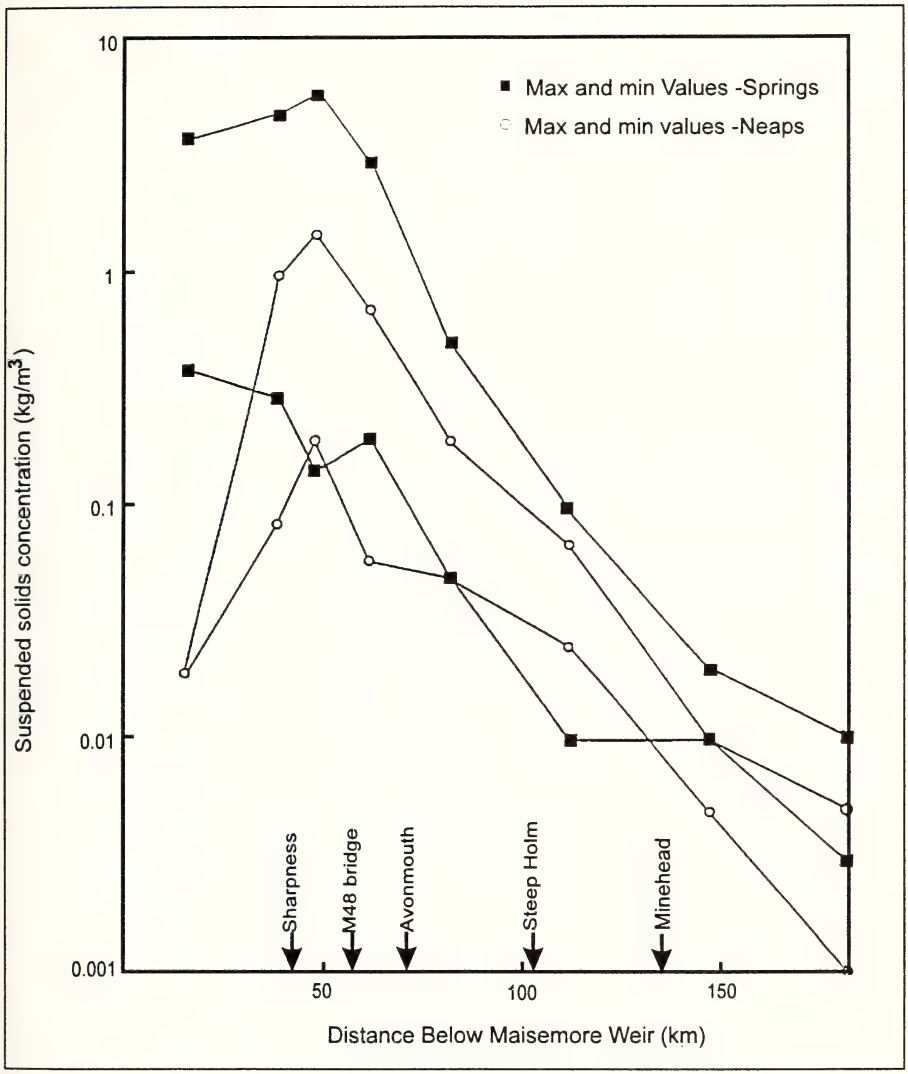

FIGURE 5 The turbidity maximum and the suspended sediment distribution for spring and neap tides. From Severn Barrage Report (1989).

Comparison with the turbidity distribution shows that the area of the blooms is clearly limited by suspended sediment. *Phaeocystis* is not normally grazed and is considered to be a nuisance alga. The levels of chorophyll-a within the bloom area exceeded the

Urban Waste Water Treatment Directive Guideline levels of 10 mgm^{-3} and the waters would be classified as eutrophic.

In shallow water, at times when turbidity is reduced, there is the possibility that algal blooms and eutrophication could appear, and this has occasionally happened in the Lower Bristol Avon. The important limitation on the primary productivity is thus the distribution of suspended sediment.

SUSPENDED SEDIMENT

In all estuaries there is a turbidity maximum located near the head of the salinity intrusion. This is generated by a combination of the residual currents created by the mixing of saline and fresh water, the asymmetry of the tidal currents, and the settling and re-suspension of the sediment during the tide. In the Severn it is the two latter processes that dominate. The magnitudes of the concentrations depend on there being mud available, together with currents high enough to regularly entrain the particles into suspension. The concentrations of suspended sediment in the Severn are amongst the highest in the world, and Figure 5 shows the longitudinal dis-tribution of tidally- and depth-averaged concentration. The peak concentrations occur in the vicinity of the M4 Road Bridge, but concentrations are still of the order of 100 parts per million (mg per litre) at the Holms, and remote sensing has demonstrated appreciable concentrations as far as Nash Point in South Wales (Collins, 1983).

The highest concentrations of suspended sediment above Bridgwater Bay occur on the English side of the estuary (Kirby & Parker, 1983). There is considerable movement of sediment through the cross section of the Holm Islands, and from a study of the timing of observed suspension peaks it has been suggested that the sediment passing Steep Holm in suspension was derived from erosion from the bed at positions off Sand Point on the ebb tide, and Bridgwater Bay on the flood tide (HR, 1981). The circulation pattern of fine sediment postulated by Parker & Kirby (1982) shows that the high gradient zone acting as the western limit to the area of highest concentrations coincides with the front described above, suggesting that there is a hydrodynamic limit to the dispersion of the suspended sediment, and to the area of maximum inhibition of the light penetration.

Thus the limit of suspended sediment, the light inhibition, and the consequent pattern in occurrence of algal blooms, are also indicators of the outer limit of the estuary being seaward of the Holm Islands.

CONCLUSIONS

The outer limit of the estuary should be considered as:

- located to the west of the Holm Islands, when defined as the position where salinity is less than 95% of the adjacent offshore seawater for 95% of the time.
- at, or to the west of the Holm Islands, when defined on topographic considerations.

This limit is also the extent of the turbidity maximum, which is characteristic of high tidal range estuaries. The turbidity has a strong control over the light penetration and the growth of phytoplankton, and is important in water quality.

DEFINITION OF THE SEVERN ESTUARY

A line connecting Lavernock Point, through the Holm Islands to Howe Rock on Brean Down has now been accepted as the seaward limit of the Severn Estuary for the purposes of the European Community's Urban Waste Water Treatment Directive. Similarly, the seaward limit of the Parrett Estuary is a line joining Howe Rock to Hinkley Point. The implications are that effluent discharges in those estuaries should require secondary treatment.

ACKNOWLEDGEMENT

This paper is based on evidence prepared for the Bristol City Council and Woodspring District Council in the successful judicial review against the decision of the Secretary of State for the Environment to designate the Severn Estuary west of the M48 Severn Bridge as 'coastal waters'. Their permission for publication is gratefully acknowledged.

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RECENT CHANGES IN INTER-TIDAL AND NEAR SUB-TIDAL MORPHOLOGY IN BRIDGWATER BAY.

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ABSTRACT

Major channel changes have taken place in south Bridgwater Bay since the mid 1980s. This account compares recent and historical hydrographic surveys, briefly reviews the hydrodynamics, sediment transport and geomorphology of the Bay based on published and unpublished literature, and considers possible causes for the intertidal and near sub-tidal topographical changes. Possible explanations include changes in wave energy patterns because of variation of size and position of the offshore Culver Sands, alterations in sediment supply, and modifications of land drainage patterns. The Culver Sands are estimated to have decreased in volume by approximately 30 million cubic metres between 1961 and 1989 and to have changed shape and elevation, making Bridgwater Bay more exposed to wave energy. Improved land drainage and a trend towards wetter winters and drier summers over the period of the changes may have forced a new channel to deep water. Inter-tidal erosion may have assisted the change, with insufficient sand in the system to allow rapid replacement of sediment in the newly eroded channel. Contaminants in the sediments and increased turbidity may have decreased biological binding and made channel erosion easier.

INTRODUCTION

Significant changes in the inter-tidal and near sub-tidal topography of south Bridgwater Bay first came to notice because of their effect on navigational approaches to Burnham-on-Sea and the River Parrett. The Gore Sands moved south into the previously marked approach channel, requiring shipping to enter on a more southerly track. Also a more northerly, previously minor channel which existed only when the tide was above mean level, has deepened (see Figures 1 and 2). The flow from the Parrett Estuary at low water is now through the more northerly channel, which is deep but comparatively narrow. The former main channel dries in places at low water spring tides.

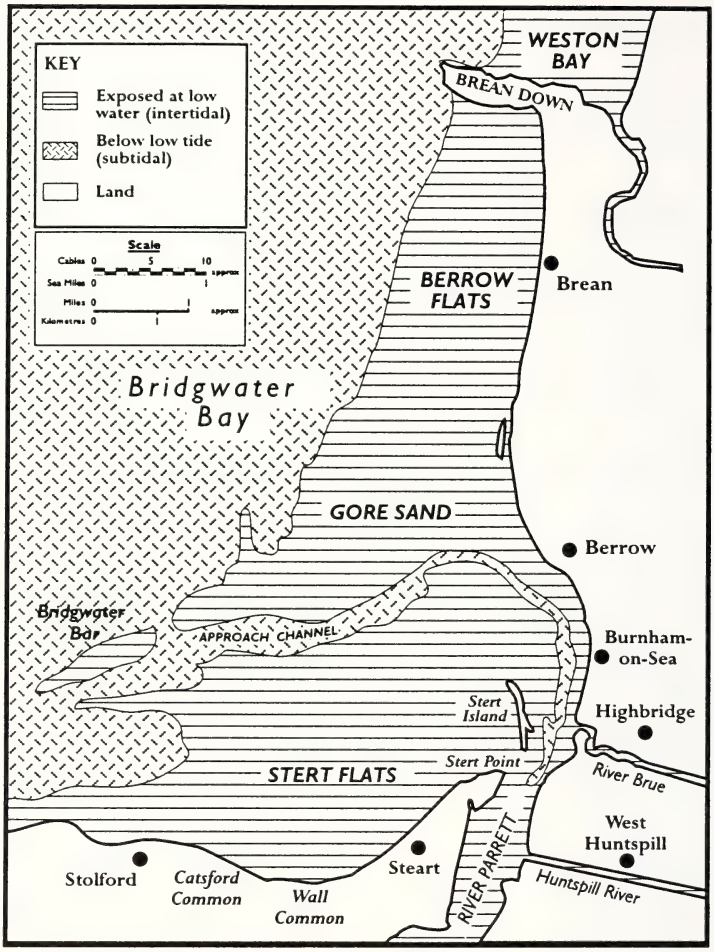

FIGURE 1. Bridgwater Bay, showing position of the approach channel to Burnham-on-Sea from the mid-19th Century to the mid-1980s.

HISTORICAL RECORD

From examination of historical Admiralty surveys and other information, it would appear that the changes taking place are the largest since the eighteenth century, an approximate equilibrium having existed for in excess of two hundred years. Old maps and charts of Bridgwater Bay from the eighteenth century show the Parrett channels at low water as at least bifurcated, and a chart by Cope (1723) shows possibly three channels. Kendall (1937) notes that in 1739 a channel to the north-east of Gore Sands was dammed by an accumulation of ice, then mud, and became permanently blocked. However a plan of Stert Fisheries in 1776 shown by Kendal (1939) clearly indicates two low-water channels from the Parrett entrance across the Bay.

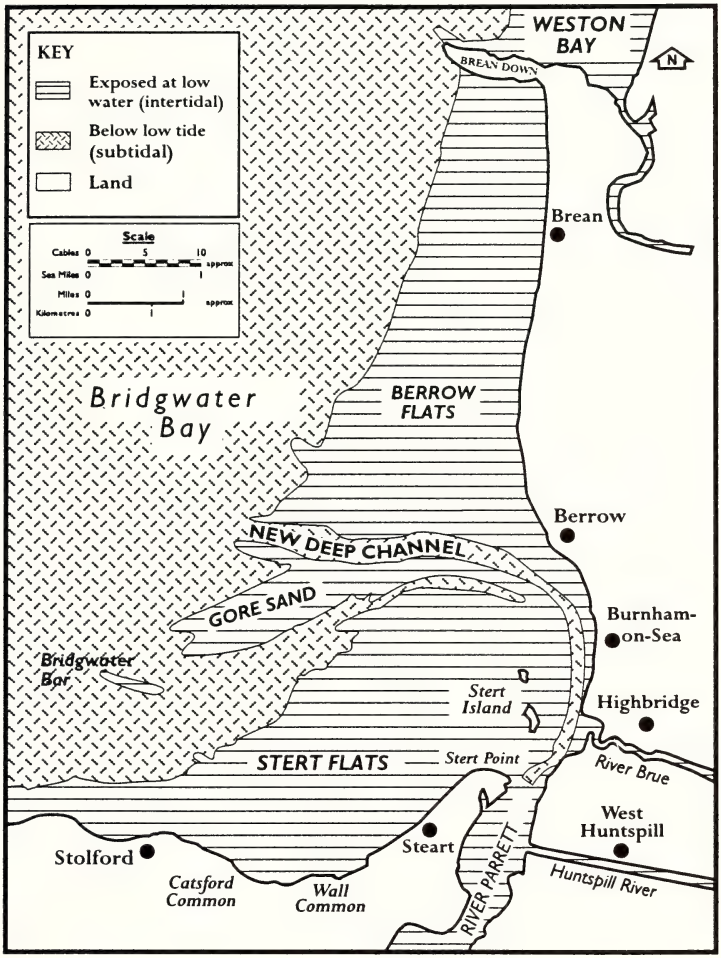

FIGURE 2. Bridgwater Bay in the 1990s, showing the new deep channel formed in the 1980s.

The first accurate hydrographic survey of Bridgwater Bay was undertaken by Denham in 1831, for the Hydrographer of the Navy. Subsequently the Admiralty surveyed at approximately thirty-year intervals until the 1960s when the port approach surveys became the responsibility of the harbour authority. Examination of charts indicates that the channel shown in all the surveys from 1831 to the 1961/65 survey is very similar throughout, indicating an approximate equilibrium. There is sometimes indication of a more northerly channel, but this is only very minor. Of course, with thirty-year survey intervals there may have been major changes in the intervening

periods, but examinations of buoy positions in corrected charts published between surveys suggest that this is not the case. Similarly, the surveys between 1993 and 1995 show only minor variations, and it could be that a new equilibrium has developed. The major changes to the channels took place in the late 1980s (personal observation) over a period of a year or two.

IMPORTANCE OF THE CHANGES

In addition to the obvious implication for navigation, any major changes in the morphology of the area warrant monitoring for two other reasons. First, the profile of the inter-tidal has a major influence on wave energy reaching the coast. North of Burnham-on-Sea sand dunes act as the defence against flooding of large amounts of adjacent land which lies below high water spring tide level. Any increases in wave energy impacting the dunes during storm conditions combined with rising sea levels could have implications for flood defence. Secondly, Bridgwater Bay contains a National Nature Reserve and is a Site of Special Scientific Interest, a Special Protection Area under the European Union's Birds Directive (1979), a Wetland of International Importance under the Ramsar Convention and is a part of the possible Severn Estuary Special Area of Conservation under the Habitats Directive (1992). Major topographical changes in the Bay may affect its capacity to carry wildlife and alter the important habitats that led to these designations.

The aim of this paper is to consider possible causes for the channel changes in the late 1980s, and to do this requires investigation of the physical systems of the area.

Bridgwater Bay may be thought of as an extension of the Bristol Channel at high water and an extension of the Somerset Levels at low water, so the physical systems of the Bristol Channel and the formation of the Somerset Levels are briefly considered before looking at the detail of Bridgwater Bay.

THE BRISTOL CHANNEL HYDRODYNAMICS AND SEDIMENTS

The hydrodynamics of the Bristol Channel are dominated by the effects of tides, the second largest in the world due to the length of the channel relative to that of the tidal wave (Fong & Heaps, 1978). As the predominantly semi-diurnal tidal wave of the North Atlantic passes up the Bristol Channel from the Celtic Sea it is additionally amplified by energy propagating into a converging cross section (Prandle & Rahman, 1979). The range of mean spring tides off Burnham-on Sea is 11.0 m, rising to 12.2 m at Avonmouth.

The Bristol Channel is exposed to the long wave fetch from the west where frequent strong winds cause a high average value of wave energy. There are long periods when wave-induced velocities near the bed are small, but exceptional velocities in excess of 2 m/s have been estimated as possible in parts of Bridgwater Bay (Severn Tidal Power Group, 1993). When superimposed on the high tidal currents these storms can have major effects on sediment transport. Their effect will vary according to wind speed, direction and duration, and also according to the relationship between the time of a storm and the diurnal and monthly tidal cycles.

The water circulation in the Channel is complicated by density effects; more from suspended sediment than from salinity variations (Wolf, 1987), and far more by transverse gradients than horizontal gradients. This circulation is important in the transport and deposition of suspended sediment.

The sea bed sediments in the Bristol Channel and Severn Estuary vary from clay to gravel and boulders. Most fine sediment seems to originate from rivers (Allen, 1991) and from erosion from the coastal margins (Kirby, 1994), whilst there appears to be no major modern source for sand (Dyer, 1984). The strong tidal currents, over 1.5m/s on spring tides, mean that sediment up to sand size can be moved by tidal effects alone. The Severn Estuary now contains relatively little sediment compared with most estuaries, and the Bristol Channel is similarly starved, though the strong tidal currents mean that a large portion of that sediment is in motion, particularly at spring tides, and the water is noted for its turbidity.

THE SOMERSET LEVELS AND THE RIVER PARRETT

Merging into Bridgwater Bay, and a potential source for sediment, the Somerset Levels are largely ancient tidal flats and lagoons. Peats cover the lowland, overlain with freshwater alluvial deposits and a coastal belt of marine clay. Between the coastal clay belt and the tidal flats of Bridgwater Bay, are blown sand deposits, mainly built over at Burnham-on-Sea, but forming dunes at Berrow and Brean.

The processes which laid down the Quaternary deposits of the Somerset Levels and intertidal Bridgwater Bay have been described by Kidson & Heyworth (1976). The main solid geology morphological features are thought to have been established by the late Tertiary or early Quaternary (*c.* 2 Ma BP). During the Devensian (70,000 to 10,000 BP), the last glacial stage in Britain, sea level was as much as 120m below OD (Hawkins, 1971). During the Holocene sea level rise, sufficient sediments were available for the valleys to be infilled with alluvium, with peat formed when conditions were suitable. Borehole information has shown the Holocene stratigraphy to have a depth of up to 30m and to comprise thick estuarine clays with laminations of sand and silt, and brackish or freshwater peat layers up to 2m thickness (Kidson & Heyworth, 1976).

The height of the alluvial flats is similar to high water spring tides, with the inland peat moors having a lower level than the coastal belt. Until the thirteenth century the levels were an area of swamp and marsh. Reclamation was started in the middle ages. Since 1945 in particular, flooding has been controlled by the improvement of banks, sluices, drains and sea walls, improved pumping systems and the provisions of relief channels. By the late 1980s it was possible to discharge winter flood water more quickly than ever before, and this increased 'flashiness' may have significance for channels in Bridgwater Bay.

The River Parrett and its tributaries have a catchment of some 1500 km^2 . The lower Parrett is extremely estuarial in nature with a low-water volume only a few per cent of that at high water. About 100,000 tonnes of mud move in and out of the Parrett estuary at Stert Point during spring tides (Hydraulics Research, 1981), but although

there are seasonal and spring/neap variations, channel cross-sections in the estuary remain in approximate equilibrium. There is a tendency for siltation to occur in the summer, with flushing by winter rains when biological binding of the sediments is reduced.

BRIDGWATER BAY

Bridgwater Bay is shaped in the mirror image of the letter L, with solid geology on the south-west shore, but from Stolford to the mouth of the Parrett and from Burnham-on-Sea to Brean Down the intertidal soft sediments are contiguous with the alluvium of the Levels. The Nature Conservancy Council has classed Bridgwater Bay as an embayment-type estuary. The sub-estuary of the River Parrett forms a separate bar-built estuary within the bay (Severn Tidal Power Group, 1993). A feature of bar-built estuaries is the availability of sediment to be reworked by tidal hydrodynamics and waves.

Being open to the west, the Bay is more exposed to wave action than are many estuaries. Significant wave heights (the average height of the highest one-third of waves) are in the region of 3m, and are caused mainly by storms from the west or north west. Westerly storms are around ten times more frequent than those from other directions (Kirby, 1996). The combination of this wave energy with tidal currents exceeding 1.5 m/s at the bar and a tidal excursion of over 15 km at spring tides make Bridgwater Bay a very dynamic environment.

It has been estimated from Admiralty Hydrographic surveys that between 1961 and 1989, the Culver Sands decreased in volume by approximately 30,000,000 m^3 , stopped drying, moved considerably and altered in shape from a NE/SW bank to a circular area of shallow water (Severn Tidal Power Group, 1993). The changes in the Culver, which are shown in Figure 4 below, have made Bridgwater Bay much more exposed to wave action, and modelling of wave patterns (Severn Tidal Power Group, *op. cit.*) shows focusing of energy in the area of the new deep channel.

Surface sediments in Bridgwater Bay vary from fluid mud to shingle (Figure 3). Triassic rocks are evident off Hinkley Point, some shingle between Hinkley Point and Steart and some bedrock of mainly Carboniferous limestone off Brean Down. In most places, however, the bed is formed of soft deposits of Holocene clays, silts, sand and peat.

The Holocene deposits are frequently overlain by mobile sand, shingle and mud. Near Bridgwater Bar, up to 3 m of the sediment thickness is thought to have been in motion in the previous 50 years (Mantz & Wakeling, 1981). A maximum of 3 cm depth would be transported by spring tidal currents alone, so the greater depths were attributed to storm events. In the course of an archaeological assessment of parts of the Gore Sands and Stert Flats, McDonnell (1995) confirmed this mobility. However, significant changes of height and distribution of sand were noted over as little as three or four tides, especially in the mid to lower inter-tidal area. The sand appeared to be the most dynamically mobile deposit and could completely obscure the remains of a large fish weir over a matter of only a few days. Soft mud to about 0.7 m thickness

was noted as overlying the firmer deposits in the upper to mid inter-tidal on parts of Stert Flats, but in the lower inter-tidal the thickness was greater than this.

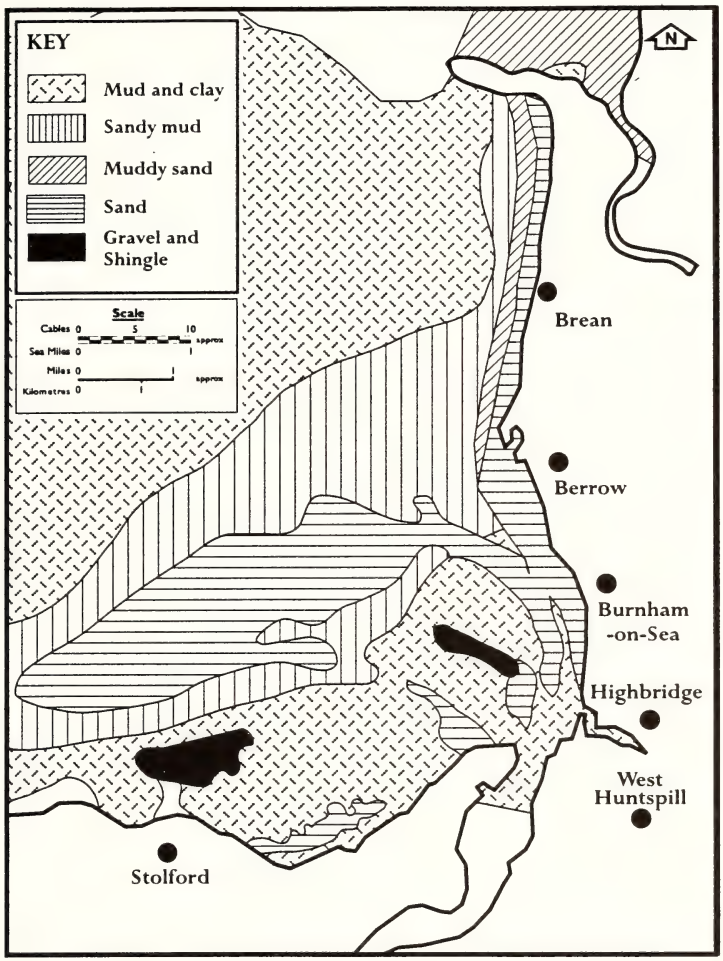

FIGURE 3. Bridgwater Bay bed sediments (after British Geological Survey).

In 1996, Coastline Surveys Ltd modelled seabed elevation changes over an area of approximately 14.6 km^2 based on four hydrographic surveys of the approach channels between 1993 and 1995. Estimated volume changes are shown in Table 1. Seasonal variations with erosion during the winter and accretion during the summer were in the order of 5M m^3 and no long term pattern could be identified. Instability was noted in the outside bend of the River Parrett offshore of north Burnham. The eastern edge of the inter-tidal banks between the north and south channels oscillated north and south,

and the beds of both channels showed instability which was considered to be the natural migration of bedforms along the seabed.

Kirby & Parker (1980), calculated subtidal mud deposits of at least 270 million tonnes. Stable areas and areas of erosion and deposition were identified, with net accretion. It is of some importance that the area off the south channel was identified as depositional, that off the new deep channel as erosional. Bridgwater Bay was shown to act as both a source and a sink for fine sediment in the Bristol Channel and, by implication, for the Parrett Estuary. The thickness of settled mud was found to be extremely variable across the area.. Kirby (1996) considers that this mud accumulation is the result of the loss of depositional areas by the construction of sea walls and river banks.

TABLE 1. Volume Analysis from Hydrographic Surveys of part of south Bridgwater Bay

Original surface	*Final Surface*	*Net Change - M m^3*
July 1993	March 1994	5.1 erosion
March 1994	July/September 1995	5.6 accretion
July/September 1995	November 1995	4.2 erosion
July 1993	November 1995	3.6 erosion

Kirby &Parker (*op. cit.*) identified the intertidal area between Hinkley Point and Brean Down as erosional and this erosion, particularly off Brean and Steart is thought to be breaking down older Holocene sediments to produce fine sediment and sand (Severn Tidal Power Group, 1993). MacLaren *et al.* (1993) using statistical analysis of sediment grain sizes collected by grab samples, considered that net sand erosion occurs on the beach and near-shore sand of east Bridgwater Bay. Kirby (1992) measured height/area relationships at Stert and Berrow Flats where the hypsographic (area/height) curve was found to be markedly concave. A concave profile is indicative of an eroding muddy foreshore, thus confirming the other work. The profile at Cardiff Bay, which occupies a similar down-estuary location on the opposite bank, shows double-convexity, which indicates long term accretion. The contrast in curves is probably accounted for by Bridgwater Bay being far more exposed than Cardiff Bay.

The first work on sediment transport *direction* in Bridgwater Bay involved detailed longshore drift experiments with marked pebbles, from Lilstock to Stert Point between 1955 and 1964 (Kidson & Carr, 1960;, Kidson, 1960; Carr, 1965). Average easterly movement occurred both of materials (e.g. 767 m/yr at Hinkley Point) and ridges (e.g. 188m at Catsford Common and 18m at Wall Common between 1957 and 1964). Kidson & Manton (1973) confirmed continuing movement of shingle ridges around Catsford and Wall Commons, using photogrammetric techniques.

Small waves and wind move sand-sized particles up to the beach and dunes at Brean, Berrow and Burnham. Sand eroded from the beach and near-shore are considered to exhibit exceptionally strong trends indicating down-estuary transport (McLaren *et al.*, 1993). The sand is then thought to move towards the Parrett channel where some is swept out to the Gore Sands and Bridgwater Bar (see Figure 4). The origin of the beach sand, then, appears to be from inter-tidal erosion and erosion of the dunes at Brean and north Berrow.

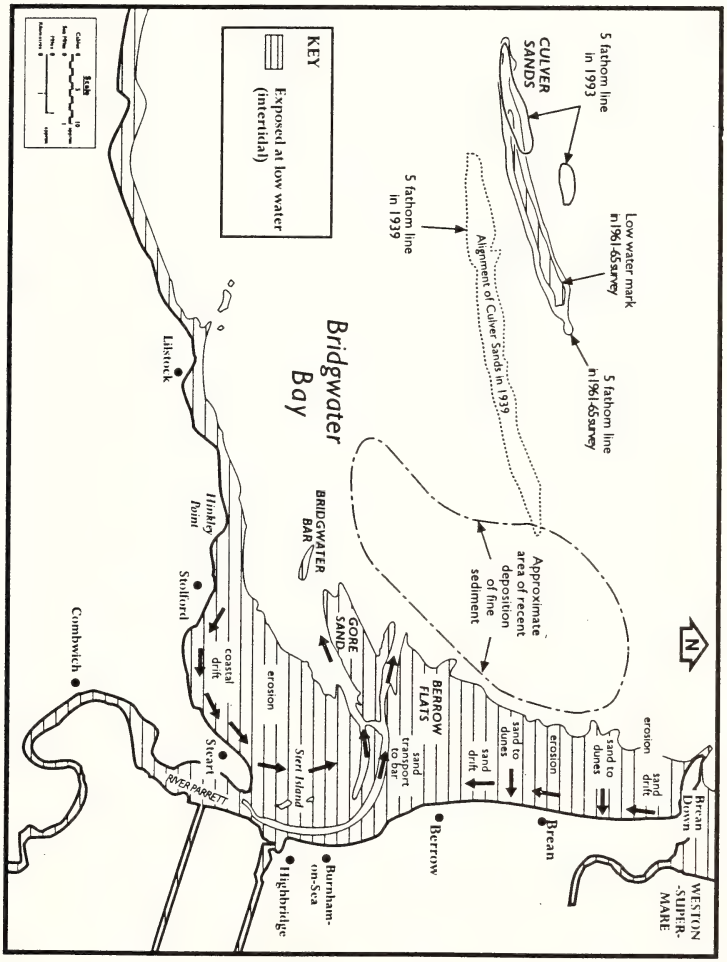

Figure 4. Sediment processesin Bridgwater Bay (after Severn Tidal Power Group (1993))

Fine sediment transport is more complicated than sand transport. With mud and clay, the link between sediment movement and the physical forces on the sediment grains is not straightforward. In fine sediment, cohesion occurs because of electrostatic

attraction between grains and because of biological films surrounding the grains. McLaren *et al.* (1993) postulated mud transport from the Parrett Estuary, with dynamic equilibrium in south Bridgwater Bay and net erosion in north Bridgwater Bay. These findings differed from some earlier studies. For example Imienwarin (1988) indicated south-easterly directed transport at the time of deposition, relating to the flow of the main estuary rather than the flow from the Parrett. These discrepancies were considered to result from either differences in time scale of the different methods used, or discrepancies caused by time lags between water movement and the movement of sediment. Mud may also move to the low inter-tidal and near sub-tidal areas by down-slope drainage, particularly during heavy rain at low water spring tides.

To summarise from previous work:

1. Changes in the Culver Sands since 1961 must have altered wave energy reaching Bridgwater Bay.
2. Fine sediments have zones of accretion and erosion in the near subtidal, with net accretion. Accretion has been identified off the south channel, erosion off the new north channel. Transport directions of fine sediments are uncertain.
3. The intertidal Holocene deposits are eroding, in particular off Steart and Brean, with ephemeral shingle, sand and mud overlying Holocene clay and peat. There are considerable seasonal variations in the sediment cover.
4. The supply of sand to the beach and upper intertidal has not been conclusively identified but is probably from inter-tidal erosion and/or erosion of the dunes at Brean.

Figure 4 shows a conceptual plan of the sediment system in Bridgwater Bay.

POSSIBLE REASONS FOR THE CHANNEL CHANGES

1. Changes to the Culver Sands shown in Figure 4 must have a major influence on the wave energy reaching intertidal Bridgwater Bay, and modelling shows a focusing of energy in the area of the new deep channel. The late 1980s had several major winter storms and these storm events alone, combined with the decreased protection from the Culver Sands may have been sufficient to erode the soft deposits in the new channel area.
2. Land drainage was significantly altered by the 1980s, and several summer droughts followed by heavy winter rains took place during that period. The National Rivers Authority's 'Somerset Moors and Levels Studies' (Tatem, K. W, 1995), shows data that suggest a trend towards wetter winters and drier summers between 1960 and 1995. Sand bars build up on the bed of the Parrett Estuary during dry periods. Rapid flushing during the winter because of heavy rains may have moved some of this sand deposit across the existing main channel and forced a new channel to deep water in the more northerly position.

3. The change may have been assisted by the general intertidal erosion, and there may be insufficient sand in the system to permit rapid infilling of the channel and reversion to the previous situation.
4. Contaminants in the sediments (Little & Smith, 1994), and increased turbidity over recent years because of the loss of inshore deposits (Kirby, 1996), may have decreased biological binding of sediments and made erosion by storm events or fresh water runoff easier, or it is possible that the change was caused by a combination of all four of the reasons postulated above.

CONCLUDING REMARKS

The channel changes identified in south Bridgwater Bay, combined with known intertidal erosion off Steart and Brean give rise to several concerns. The new channel may allow greater wave energy to impact the dunes in north Burnham-on-Sea, and there were indications of this happening during the winter of 1996/97 when lateral dune erosion of one or two metres occurred in places. The effect of the channel changes on sediment circulation is not known, but it is possible that the existing intertidal erosion will be accelerated.

Changes in the intertidal Bridgwater Bay may have significance for the general ecology of the area.. The channel changes and intertidal erosion could affect wildlife carrying capacity, since the intertidal mudflats are important as they support large numbers of invertebrates, making them good feeding areas for waders and wildfowl.

The coastal processes within Bridgwater Bay are not yet fully understood; for example the source of sand supply of the beach has not been conclusively established. It is encouraging that study of the coastline evolution has been identified as an essential part of the Shoreline Management Plan being formulated by the Somerset and North Devon Coastal Group, as it is essential for future good management in the Bay that knowledge of the physical systems is improved.

ACKNOWLEDGEMENTS

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A CROSS-REFERENCED INDEX TO THE *PROCEEDINGS*, 1971-1995

There follows a cross-referenced index to the Society's *Proceedings* for the twenty-five years 1971-1995, that is, for Vol. **32** part 2 to Vol. **55**. A volume formerly covered five years, but changes in production methods meant that Vol. **32** part 2 for 1972 was followed by Vol. **33** for 1973, and since then each volume has contained a single year's issue, the volume number being 1940 less than the year.

The titles of all *Proceedings* papers are included, as are many subjects mentioned which are not in the titles, also important records from our annual reports on local plants, invertebrates, birds and mammals. The botanical references are mainly to new or rediscovered long-absent forms for Watsonian Vice-counties 6 & 34 (southern part) - that is, North Somerset and South Gloucestershire respectively. The index includes obituaries, indexed both by subject and (where known) by author, and all Presidents, with their terms of office. Besides their individual entries, items relating to certain topics are also grouped, e.g. AVON GORGE gives all references to the Gorge, and FORMS NEW TO DISTRICT collects references to the first occurrence in the area of the 31 species or varieties first recorded during the period covered.

It was not feasible to include all species mentioned in the *Proceedings*, but specialists have selected those records of the greatest significance, whether because of rarity or for some other reason. For invertebrates, the systematic name (and common name, if any, in parentheses) is followed by the order and then, in square brackets [], by indications of rarity according to the scheme explained in Volume **54,** pages 49-50: Red Data Book categories **RDB1** – endangered; **RDB2** – vulnerable; **RDB3** – rare; and **RDBK** – believed to be rare but category uncertain through lack of data; and Nationally Notable categories **Na** – known from 16 to 50 ten-km grid squares nationally and **Nb** – known from 51 to 100 ten-km grid squares nationally. In consecutive entries from the same genus, the generic name and order are not repeated. In other entries, dashes — or — — indicate repetition of the first one or two significant words in the preceding line. The items included were selected by R. J. Barnett (invertebrates), Dr R. Bradshaw, (geology), Dr M. H. Martin (botany), S. M. Taylor (ornithology and general items) and D. P. C. Trump (mammals), to whom we are grateful for their labours.

Since 1983 the annual Avon Bird Report has been published separately from the *Proceedings*. The index includes articles of general interest from the Report and the most important records – mainly of forms new to the area or of great rarities. These are indexed in the form **B95**:100, meaning "page 100 of the 1995 Avon Bird Report"

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ERRATA and ADDENDA

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P. 1 The words 'economic pressure' should be added to the last line on the page.

Pp. 4-8 The author's name, K. C. Allen, should have appeared in the headers to the left-hand pages.

Pp. 42 & 45. In each case the end of the last line of the first paragraph was inadvertently detached and moved down.

P. 45 second paragraph: delete 'night' from second line.

P. 47 third paragraph. The last two lines should read '... the exotic Velvet Ant, *Mutilla europaea*, which parasitises bumblebees; the females are wingless and ... (Note: *M. europaea* is not an ant)'.

P. 52 End of third paragraph, after '...with Chinery's 1993 GUIDE', add 'Richmond Publishing maintain their high standard with **ANIMALS UNDER LOGS AND STONES** by C. P. Wheater and H. T. Read, 1996, Naturalists' Handbook No. 22, Slough: Richmond Publishing, a must for this branch of study'.

P. 62 Add to first line: 'All these species grow in the Priddy Mineries area - see Dr Allen's paper on Botanical Walks, especially pp 12-13'

P. 86 Bibliography to **'Agriculture on the Mendips' by R. D Russell**: add the following entries:

FINDLAY, D. C. (1965) *The soils of the Mendip District of Somerset*, Memoir of the Soil Survey of Great Britain, England and Wales. Harpenden: Agricultural Research Council.

TREVELYAN, G. M. (1979), British history in the nineteenth century and after (1782 – 1919), 2nd ed., London: Longmans.

P. 127 Figure 6 was omitted . It is reproduced overleaf.

P. 131 Figure 7 was omitted. It is reproduced overleaf.

Pp.136-158 The second author's name in the left-hand page headers should read '**P. L. Smart**'.

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P. ii Past Presidents:- J. W. Tutcher took office in **1931.** The President who took office in 1945 was Sir Lewis L.**Fermor**.

Pp. xx-xxv The pages between pages xx and xxv were printed in the wrong sequence. They should be read in the order of the printed page numbers.

ERRATA and ADDENDA

NATURE IN AVON, the *PROCEEDINGS OF THE BRISTOL NATURALISTS' SOCIETY*, Vol. 55 for 1995 and **Special Issue No. 4**, ***'THE MENDIP HILLS'*** (reprinted from Vol. 55)

The geological history of the Mendip Hills and their margins, by M. J. Simms.

Figures 6 and 7, referred to respectively on page 127 and page 131, were inadvertently omitted. They are reproduced below.

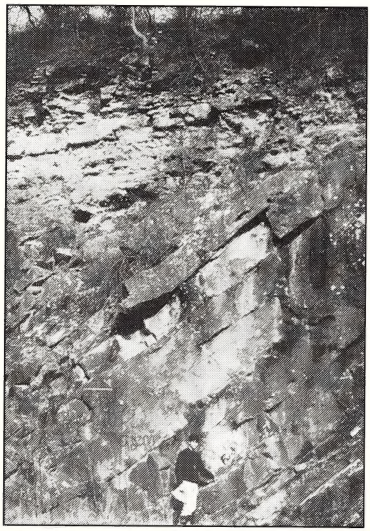

FIGURE 6 Horizontal Upper Inferior Oolite (Middle Jurassic) limestones unconformably overlying steeply-dipping Vallis Limestone (Lower Carboniferous) in the classic quarry section at Vallis Vale, near Frome.

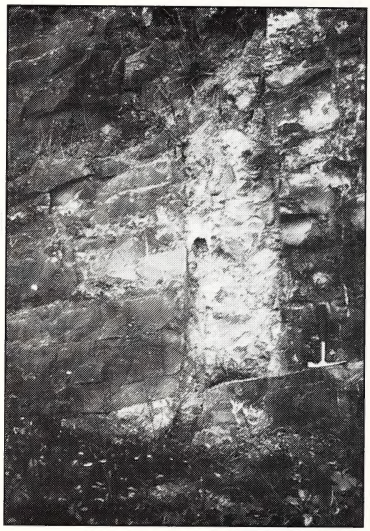

FIGURE 7. Pull-apart' Neptunean dyke in Carboniferous Limestone filled with Lower Lias silts. Offest of the dyke along a bedding plane can beseen clearly to the left of the hammer. Cloford Quarry, near Frome.

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Proceedings of the Society, Volume 56, for 1996.

Besides the annual reports on botany, invertebrates and mammals in the Bristol District, this issue contains original papers on the Severn Estuary – what it is (its legal definition has been a matter for controversy, as it determines the area within which sewage discharges have to be treated), and the nature of changes that have occurred in and around the Estuary of the River Parrett.

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